TYPICAL SECTION GENERATOR HELP

As the name implies, the purpose of this document is to provide help in using the Missouri Department of Transportation's (MoDOT) configuration for creating proposed cross-sections inside of GEOPAK Road using the Typical Section Generator. The philosophy used in creating this help is to provide useful information with a minimum amount of repetition. This has impacted the structure of the document and the use of extensive cross-references, which are available only if used in electronic form.

The document is divided into chapters and appendices. There is one chapter for each typical section. What is drawn is controlled by graphical elements in various MicroStation Files (DGN's), variables that are globally defined for the entire proposed cross-section run, and variables that are redefinable within the run using a station range or other parameter. Each chapter gives a brief description of what the typical section can draw and lists the graphical elements, the globally defined variables, and the redefinable variables that are used by that typical section. The appendices give detailed information on particular subjects, most of which are used by more than one typical section.

Because the information needed for using any of the typical sections in spread over both its chapter and a number of appendices, links are available to quickly find information within the electronic document and allow you to easily return to the previous location. You may navigate through the document by clicking on items in the Table of Contents (located on next page) or on any of the other blue text in the document. The program's **Back** and **Forward** buttons can also be used to navigate to recently viewed pages.

Table of Contents

Divided New Pavement Typical Section (DNPavt)

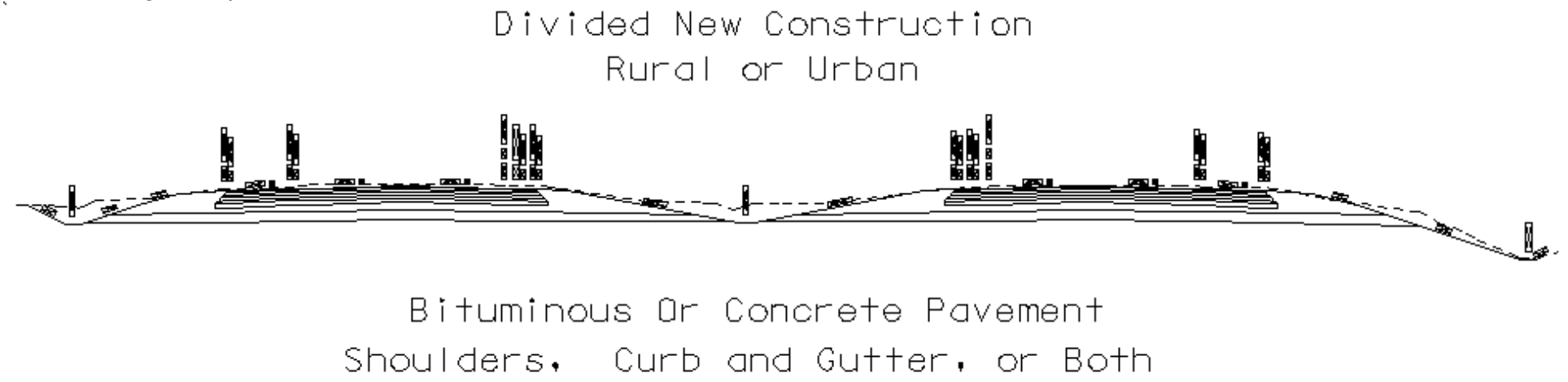
This typical section draws proposed cross sections for divided new pavement projects. It works for both rural and urban sections or a combination of the two. It draws bituminous and concrete Pavement, Rural Shoulders, Curbing With Urban Shoulders (U1 & U2), Standard Side Slopes, and Special Ditches.

This typical section resolves rural and or urban Medians including stepped barrier and retaining wall medians. There are a total of seven types of medians to choose from. The detailed options are covered later in this document.

This typical section is for new construction only. All dimensions are in master units of feet.

IMPORTANT: Set the proposed cross section run "Tolerance" value to 0.01. This is required for the criteria to work correctly.

IMPORTANT: Always include the proposed shape clusters in order from left to right. The left shape cluster should always be listed before the right shape cluster.



The rest of this section lists the scanned graphic elements, globally defined variables, and redefinable variables used by this typical section. The appendices, which can be reached through the links in the Table of Contents, give additional information.

Scanned Graphic Elements

The typical section scans design files for the following types of graphic elements. Click on an individual type to find out information about which Design and Computation Manager item is used for each item in that type.

ELEMENT TYPE	DGN DRAWING FILE
Right of Way	Right of Way DGN
Existing Ground	Cross-Section DGN
Pavement and Shoulder	Proposed Plan DGN
Curb and Gutter	Proposed Plan DGN
Curb	Proposed Plan DGN
Gutter	Proposed Plan DGN
Concrete Barrier Curb and Guardrail	Proposed Plan DGN
Roadside	Proposed Plan DGN
Side Slope and Drainage	GEOPAK Lines DGN

IF ANY OF THE ABOVE TYPES OF ELEMENTS DO NOT APPLY TO YOUR JOB YOU MUST STILL SPECIFY A VALID DESIGN FILE OR ELSE AN ERROR WILL OCCUR. THE CRITERIA FILES WILL NOT PROCESS AN ELEMENT IF IT DOESN'T EXIST.

DEFINE VARIABLES

The typical section uses the following globally define variables. Click on an individual variable for further information.

DGN File

Right of Way DGN
Cross Section DGN
Proposed Plan DGN
GEOPAK Lines DGN

Tapers File

Left Tapers File Name
Right Tapers File Name

Plot Scale

XS Scale
Plan View Scale
Plan View Flow Arrow Scale

GPK Element

Survey Baseline Name
Left Special Ditch Profiles and Right Special Ditch Profiles
Left Ditch Alignment and Right Ditch Alignment
Left Match Line Profiles and Right Match Line Profiles
Left Sidewalk Profiles and Right Sidewalk Profiles
Left Interception Special Ditch Profiles and Right Interception Special Ditch Profiles
Median Ditch Profiles
Ramp Chain Names
Match Line Chain Names
Left Top of Wall Profiles and Right Top of Wall Profiles
Left Top of Footing Profiles and Right Top of Footing Profiles
Median Top of Footing Profiles

Redefinable Variables

The typical section uses the following redefinable variables, which can have different values within the same run based on station range or another user-defined parameter. Click on an individual variable for further information. They are listed in the order they have in the run dialog box.

Right of Way Buffer Width:

_d_ROW_Buffer_Width

Pavement Structure

_s_PavementType
_d_NormalPavementSlope
_d_PavementLayer1Thick
_d_PavementLayer2Thick
_d_PavementLayer3Thick
_d_PavementLayer4Thick
_d_Aggbase1Thickness
_d_Aggbase2Thickness
_d_RockFillBaseThickness
_s_RockFillBaseDaylight
_s_RockFillBaseDaylightHSS
_d_CompensatingDepth

Underdrain

_s_DrawLeftUnderdrain
_s_DrawRightUnderdrain
_d_UnderdrainHeight
_d_UnderdrainWidth

Outside Shoulder

_s_OutsideShoulderType
_d_OutsideShoulderWidth
_d_OutsideShoulderSearchDistance
_s_LabelShoulderElevations
_d_NormalOutsideShoulderSlope
_d_ShoulderLayer1Thick
_d_ShoulderLayer2Thick
_d_ShoulderLayer3Thick
_d_ShoulderLayer4Thick
_s_ExtensionSlope

Median

_s_MedianShoulderType
_d_MedianShoulderWidth
_d_MedianShoulderSearchDistance
_d_NormalMedianShoulderSlope
_s_MedianType
_d_MedianSlope1
_d_MedianSlope1Width
_d_MedianSlope2
_d_StdMedianDitchDepth
_d_MedianDitchWidth
_d_PavedMedianThickness
_d_MaxPavedMedianWidth

Curb and Gutter

_d_CurbSearchDistance
_d_IntegralCurbHeight
_s_GutterSlopeInSuper

U2 Shoulder

_d_U2ShoulderSearchDistance
_d_U2ShoulderSlope
_d_U2ShoulderAggbaseThickness
_d_U2ShoulderWidth
_d_U2ShoulderThickness

Berm and Sidewalk

_d_BermSlope_Left
_d_BermWidth_Left
_d_SidewalkSlope
_d_BermSlope_Right
_d_BermWidth_Right
_d_SidewalkThickness

Standard Ditch

_d_DitchForeSlope1_Left
_d_DitchForeSlope2_Left
_d_DitchWidth_Left
_d_DitchForeSlope1_Right
_d_DitchForeSlope2_Right
_d_DitchWidth_Right
_d_DitchForeSlope1Width_Left
_d_StandardDitchDepth_Left
_d_DitchBackSlope_Left
_d_DitchForeSlope1Width_Right
_d_StandardDitchDepth_Right
_d_DitchBackSlope_Right

Fill Slope

_d_FillSlope1_Left
_d_FillSlope1Width_Left
_d_FillSlope2_Left
_d_FillSlope1_Right
_d_FillSlope1Width_Right
_d_FillSlope2_Right

Force Closed Slope

_s_LeftForceClosingSlopes
_d_LeftForcedCutSlope
_d_RightForcedCutSlope
_s_RightForceClosingSlopes
_d_LeftForcedFillSlope
_d_RightForcedFillSlope

Right of Way Constrained Slope

_s_LeftROWConstrainedSlope
_s_RightROWConstrainedSlope

Special Ditch Label:

_s_SpecialDitchLabel

Draw Ditches in Plan View:

_s_DrawDitchesInPlanView

Rock Benching

_d_BenchingBackSlope
_d_BenchHeight
_s_TopBenchWidth
_d_BenchWidth

Chain Search Distance

_d_RampChainSearchDistance
_d_MatchLineChainSearchDistance

Entrance

_d_EntrancePadWidth
_d_EntranceVertCurveLength
_d_Max_Type1_Driveway_Slope
_d_Max_Type1_Roll_Over_Slope
_d_Max_Type2_Driveway_Slope
_d_Max_Type2_Roll_Over_Slope
_d_Max_Type3_Driveway_Slope
_d_Max_Type3_Roll_Over_Slope
_d_Max_Type4_Driveway_Slope
_d_Max_Type4_Roll_Over_Slope
_d_Max_Type5_Driveway_Slope
_d_Max_Type5_Roll_Over_Slope

Retaining Wall

_d_DepthBelowProposedGroundInCut
_d_HeightAboveExistGroundInCut
_d_DepthBelowExistGroundInFill
_d_HeightAbovePropGroundInFill
_d_WallWidth
_s_WallHeight
_d_BackWallHeightInCut
_d_BackFootingWidth
_d_TotalFootingWidth
_d_FootingThickness
_d_KeyOffset
_d_KeyWidth
_d_KeyHeight
_d_AdjacentWallSearchDistance

Levee and Interception Ditch

_s_LeveeAdjacentToDitch
_d_LeveeHeight
_d_LeveeForeslope
_d_LeveeBackslope
_d_InterceptionDitchWidth
_d_InterceptionDitchBackslope

Non-Standard Curb and Gutter

_d_GutterSlope
_d_GutterWidth
_d_CurbFaceWidth
_d_TopCurbWidth
_d_CurbHeight
_d_GutterThickness
_d_GutterBaseSlope

Divided Reconstruction Typical Section (DRecon)

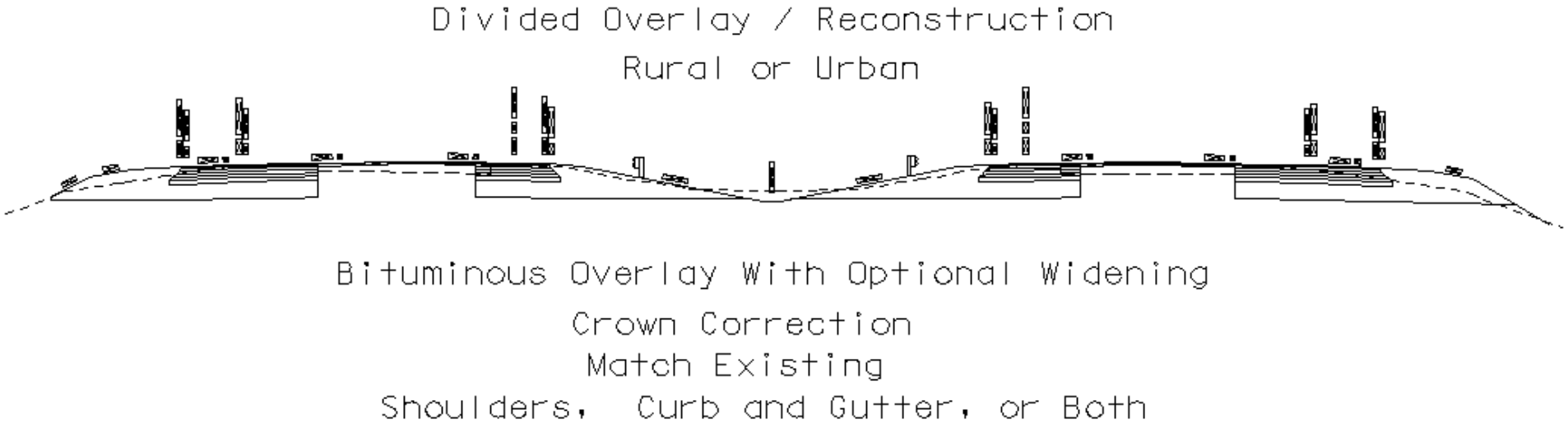
This typical section draws proposed cross sections for divided Reconstruction projects. It works for both rural and urban sections or a combination of the two. It draws up to two overlay layers and an optional widening with bituminous or concrete Pavement using either a "match existing" or "crown correction" approach. It draws bituminous and concrete Pavement, Rural Shoulders, Curbing With Urban Shoulders (U1 & U2), Standard Side Slopes, and Special Ditches.

This typical section resolves rural and or urban Medians including stepped barrier and retaining wall medians. There are a total of seven types of medians to choose from. The detailed options are covered later in this document.

This typical section is for reconstruction only. All dimensions are in master units of feet.

IMPORTANT: Set the proposed cross section run "Tolerance" value to 0.01. This is required for the criteria to work correctly.

IMPORTANT: Always include the proposed shape clusters in order from left to right. The left shape cluster should always be listed before the right shape cluster.



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Scanned Graphic Elements

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ELEMENT TYPE	DGN DRAWING FILE
Right of Way	Right of Way DGN
Reconstruction Existing Edge of Pavement	Existing TOPO DGN
Existing Ground	Cross-Section DGN
Saw Cut	Proposed Plan DGN
Pavement and Shoulder	Proposed Plan DGN
Curb and Gutter	Proposed Plan DGN
Curb	Proposed Plan DGN
Gutter	Proposed Plan DGN
Concrete Barrier Curb and Guardrail	Proposed Plan DGN
Roadside	Proposed Plan DGN
Side Slope and Drainage	GEOPAK Lines DGN

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DEFINE VARIABLES

The typical section uses the following globally define variables. Click on an individual variable for further information.

DGN File

Existing TOPO DGN
Right of Way DGN
Cross Section DGN
Proposed Plan DGN
GEOPAK Lines DGN

Tapers File

Left Tapers File Name
Right Tapers File Name

Plot Scale

XS Scale
Plan View Scale
Plan View Flow Arrow Scale

GPK Element

Survey Baseline Name
Left Special Ditch Profiles and Right Special Ditch Profiles
Left Ditch Alignment and Right Ditch Alignment
Left Match Line Profiles and Right Match Line Profiles
Left Sidewalk Profiles and Right Sidewalk Profiles
Left Interception Special Ditch Profiles and Right Interception Special Ditch Profiles
Median Ditch Profiles
Ramp Chain Names
Match Line Chain Names
Left Top of Wall Profiles and Right Top of Wall Profiles
Left Top of Footing Profiles and Right Top of Footing Profiles
Median Top of Footing Profiles

Redefinable Variables

The typical section uses the following redefinable variables, which can have different values within the same run based on station range or another parameter. Click on an individual variable for further information. They are listed in the order they have in the run dialog.

Right of Way Buffer Width:

_d_ROW_Buffer_Width

Pavement Structure

_s_PavementType
_d_NormalPavementSlope
_d_PavementLayer1Thick
_d_PavementLayer2Thick
_d_PavementLayer3Thick
_d_PavementLayer4Thick
_d_Aggbase1Thickness
_d_Aggbase2Thickness
_d_RockFillBaseThickness
_s_RockFillBaseDaylight
_s_RockFillBaseDaylightHSS
_d_CompensatingDepth

Underdrain

_s_DrawLeftUnderdrain
_s_DrawRightUnderdrain
_d_UnderdrainHeight
_d_UnderdrainWidth

Reconstruction

_s_OverlayType
_s_WideningSlope
_s_OverlayOffsetLocation
_d_OverlayThickness1
_d_OverlayThickness2

Outside Shoulder

_s_OutsideShoulderType
_d_OutsideShoulderWidth
_d_OutsideShoulderSearchDistance
_s_LabelShoulderElevations
_d_NormalOutsideShoulderSlope
_d_ShoulderLayer1Thick
_d_ShoulderLayer2Thick
_d_ShoulderLayer3Thick
_d_ShoulderLayer4Thick
_s_ExtensionSlope

Median

_s_MedianShoulderType
_d_MedianShoulderWidth
_d_MedianShoulderSearchDistance
_d_NormalMedianShoulderSlope
_s_MedianType
_d_MedianSlope1
_d_MedianSlope1Width
_d_MedianSlope2
_d_StdMedianDitchDepth
_d_MedianDitchWidth
_d_PavedMedianThickness
_d_MaxPavedMedianWidth

Curb and Gutter

_d_CurbSearchDistance
_d_IntegralCurbHeight
_s_GutterSlopeInSuper

U2 Shoulder

_d_U2ShoulderSearchDistance
_d_U2ShoulderSlope
_d_U2ShoulderAggbaseThickness
_d_U2ShoulderWidth
_d_U2ShoulderThickness

Berm and Sidewalk

_d_BermSlope_Left
_d_BermWidth_Left
_d_SidewalkSlope
_d_BermSlope_Right
_d_BermWidth_Right
_d_SidewalkThickness

Standard Ditch

_d_DitchForeSlope1_Left
_d_DitchForeSlope2_Left
_d_DitchWidth_Left
_d_DitchForeSlope1_Right
_d_DitchForeSlope2_Right
_d_DitchWidth_Right
_d_DitchForeSlope1Width_Left
_d_StandardDitchDepth_Left
_d_DitchBackSlope_Left
_d_DitchForeSlope1Width_Right
_d_StandardDitchDepth_Right
_d_DitchBackSlope_Right

Fill Slope

_d_FillSlope1_Left
_d_FillSlope1Width_Left
_d_FillSlope2_Left
_d_FillSlope1_Right
_d_FillSlope1Width_Right
_d_FillSlope2_Right

Force Closed Slope

_s_LeftForceClosingSlopes
_d_LeftForcedCutSlope
_d_RightForcedCutSlope
_s_RightForceClosingSlopes
_d_LeftForcedFillSlope
_d_RightForcedFillSlope

Right of Way Constrained Slope

_s_LeftROWConstrainedSlope
_s_RightROWConstrainedSlope

Special Ditch Label:

_s_SpecialDitchLabel

Draw Ditches in Plan View:

_s_DrawDitchesInPlanView

Rock Benching

_d_BenchingBackSlope
_d_BenchHeight
_s_TopBenchWidth
_d_BenchWidth

Chain Search Distance

_d_RampChainSearchDistance
_d_MatchLineChainSearchDistance

Entrance

_d_EntrancePadWidth
_d_EntranceVertCurveLength
_d_Max_Type1_Driveway_Slope
_d_Max_Type1_Roll_Over_Slope
_d_Max_Type2_Driveway_Slope
_d_Max_Type2_Roll_Over_Slope
_d_Max_Type3_Driveway_Slope
_d_Max_Type3_Roll_Over_Slope
_d_Max_Type4_Driveway_Slope
_d_Max_Type4_Roll_Over_Slope
_d_Max_Type5_Driveway_Slope
_d_Max_Type5_Roll_Over_Slope

Retaining Wall

_d_DepthBelowProposedGroundInCut
_d_HeightAboveExistGroundInCut
_d_DepthBelowExistGroundInFill
_d_HeightAbovePropGroundInFill
_d_WallWidth
_s_WallHeight
_d_BackWallHeightInCut
_d_BackFootingWidth
_d_TotalFootingWidth
_d_FootingThickness
_d_KeyOffset
_d_KeyWidth
_d_KeyHeight
_d_AdjacentWallSearchDistance

Levee and Interception Ditch

_s_LeveeAdjacentToDitch
_d_LeveeHeight
_d_LeveeForeslope
_d_LeveeBackslope
_d_InterceptionDitchWidth
_d_InterceptionDitchBackslope

Non-Standard Curb and Gutter

_d_GutterSlope
_d_GutterWidth
_d_CurbFaceWidth
_d_TopCurbWidth
_d_CurbHeight
_d_GutterThickness
_d_GutterBaseSlope

Draw Right of Way Lines (DrwROW)

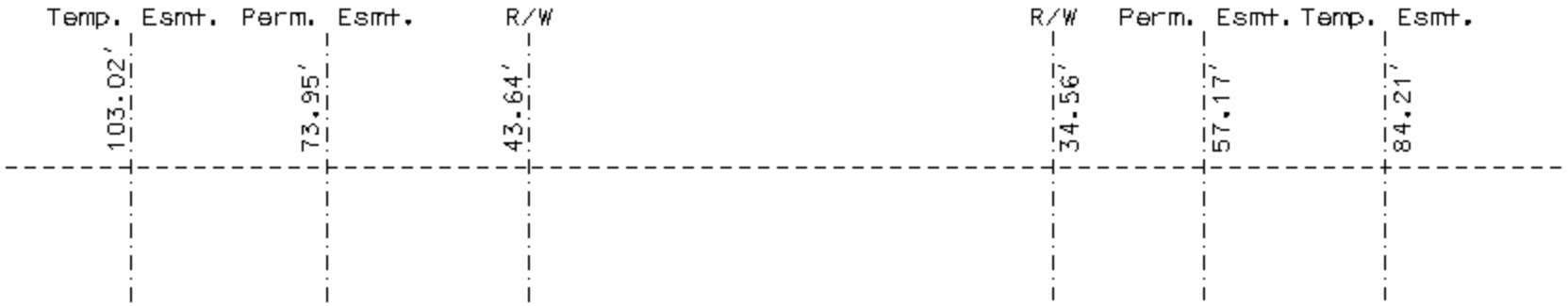
This typical section searches the right of way drawing for any instances of both existing and proposed right of way lines. If any are found, their location is drawn and labeled on the cross sections. The following plan view elements are searched for:

Existing Right of Way
Existing Right of Way Controlled Access
Proposed Right of Way
Proposed Right of Way Controlled Access
Proposed Right of Way Permanent Easement
Existing Right of Way Temporary Access
Existing Right of Way No Right of Access
Proposed Right of Way Temporary Access
Proposed Right of Way No Right of Access
Proposed Right of Way Temporary Easement

IMPORTANT: Set the proposed cross section run "Tolerance" value to 0.01. This is required for the criteria to work correctly.

Label Right of Way Locations

Multiple Instances Allowed



The rest of this section lists the scanned graphic elements, globally defined variable, and redefinable variable used by this typical section. The appendices, which can be reached through the links in the Table of Contents, give additional information.

Scanned Graphic Elements

The typical section scans a design file for the following types of graphic elements. Click on an individual type to find out information about which Design and Computation Manager item is used for each item.

ELEMENT TYPE	DGN DRAWING FILE
Right of Way	Right of Way DGN

IF ANY OF THE ABOVE TYPES OF ELEMENTS DO NOT APPLY TO YOUR JOB YOU MUST STILL SPECIFY A VALID DESIGN FILE OR ELSE AN ERROR WILL OCCUR. THE CRITERIA FILES WILL NOT PROCESS AN ELEMENT IF IT DOESN'T EXIST.

DEFINE VARIABLES

The typical section uses the following globally define variables. Click on an individual variable for further information.

DGN File

Right of Way DGN

Plot Scale

XS Scale

Redefinable Variables

The typical section uses the following redefinable variable, which can have different values within the same run based on station range or another parameter.

Right of Way Line Height

This is the height of the line in master units drawn to represent the location of existing and proposed right of way. The number **MUST** be greater than zero.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_RightofWayLineHeight = 10
    }
```

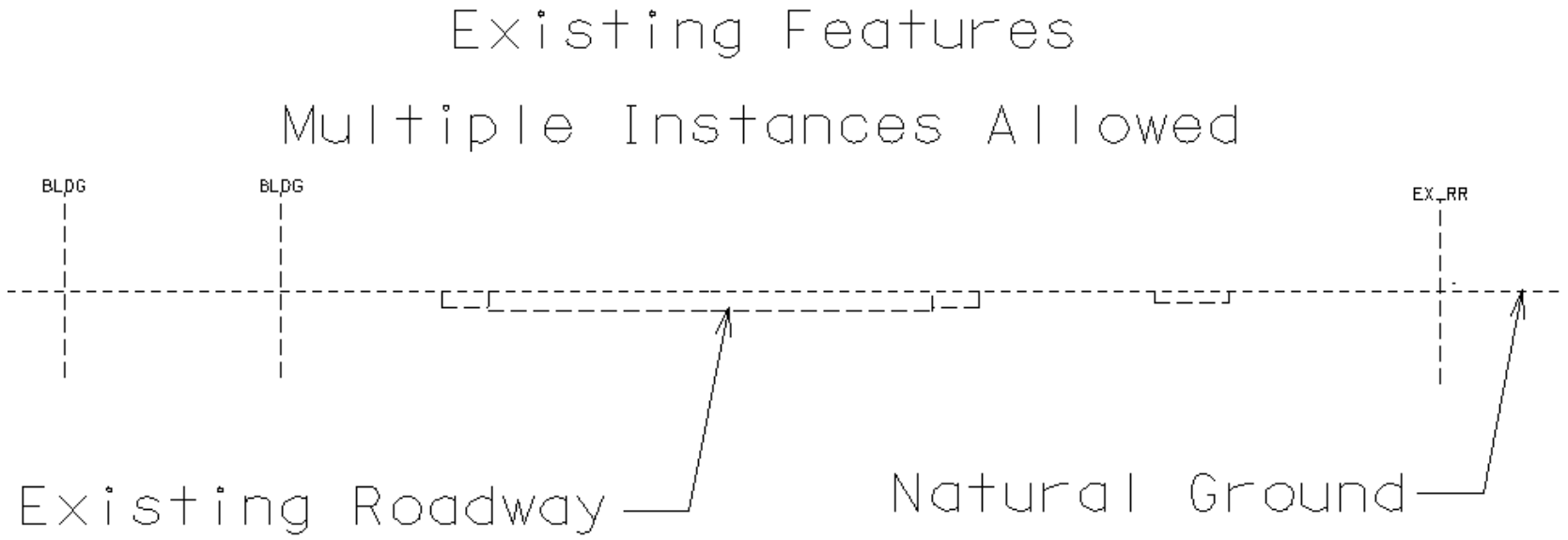
Existing Features (ExFeat)

This typical section searches a plan view drawing for certain existing features. The following existing features are drawn if found:

Existing Pavement
Existing Paved Surfaces
Existing Buildings
Existing Paved Shoulder
Existing Sidewalks
Existing Railroads
Existing Curb and Gutter
Existing Paved Ditches
Existing Wall

It handles multiple instances of the above listed items with the following restriction. There must be an even number of edges of paved surfaces in the plan view. If an odd number of pavement edges or sidewalk edges are found, a warning message is drawn stating "**Irregular Pavement Found**" and no pavement will be drawn for pavement and "**Irregular Sidewalk Found**" if an odd number of sidewalk edges are found. In other words the criteria must be able to find two lines to connect. If there are an odd number of lines found, there is not a way for the criteria to determine which two lines are to be connected.

IMPORTANT: Set the proposed cross section run "Tolerance" value to 0.01. This is required for the criteria to work correctly.



The rest of this section lists the scanned graphic elements, globally defined variables, and redefinable variables used by this typical section. Appendix 4 Existing Features gives additional information on using this typical section.

Scanned Graphic Elements

The typical section scans design file for the following types of graphic elements. Click on an individual type to find out information about which Design and Computation Manager item is used for each item.

ELEMENT TYPE	DGN DRAWING FILE
Draw Existing Features	Existing Topo DGN

IF ANY OF THE ABOVE TYPES OF ELEMENTS DO NOT APPLY TO YOUR JOB YOU MUST STILL SPECIFY A VALID DESIGN FILE OR ELSE AN ERROR WILL OCCUR. THE CRITERIA FILES WILL NOT PROCESS AN ELEMENT IF IT DOESN'T EXIST.

DEFINE VARIABLES

The typical section uses the following globally define variables. Click on an individual variable for further information.

DGN File

Existing TOPO DGN

Plot Scale

XS Scale

Redefinable Variables

The typical section uses the following redefinable variables, which can have different values within the same run based on station range or another parameter. Click on an individual variable for further information. They are listed in the order they have in the run dialog.

Existing Feature

_d_ExistingFeatureLineHeight
_s_ShowShoulders
_s_ShowSidewalk
_s_ShowPavedDitch
_s_ShowPavedSurface
_s_ShowBuildings
_s_ShowRailroadTracks
_s_ShowRetainingWall
_s_ShowCurbandGutter
_d_ExistPavtThick
_d_ExistShouldThick
_d_ExistSidewalkThick
_d_ExistPavedDitchThick
_d_ExistPavedSurfaceThick
_d_ExistCurbGutterThick
_d_ExistCurbGutterWidth

Curb Search Distance

_d_CurbSearchDistance

New Construction Left And Reconstruction Right Typical Section (NLtRRt)

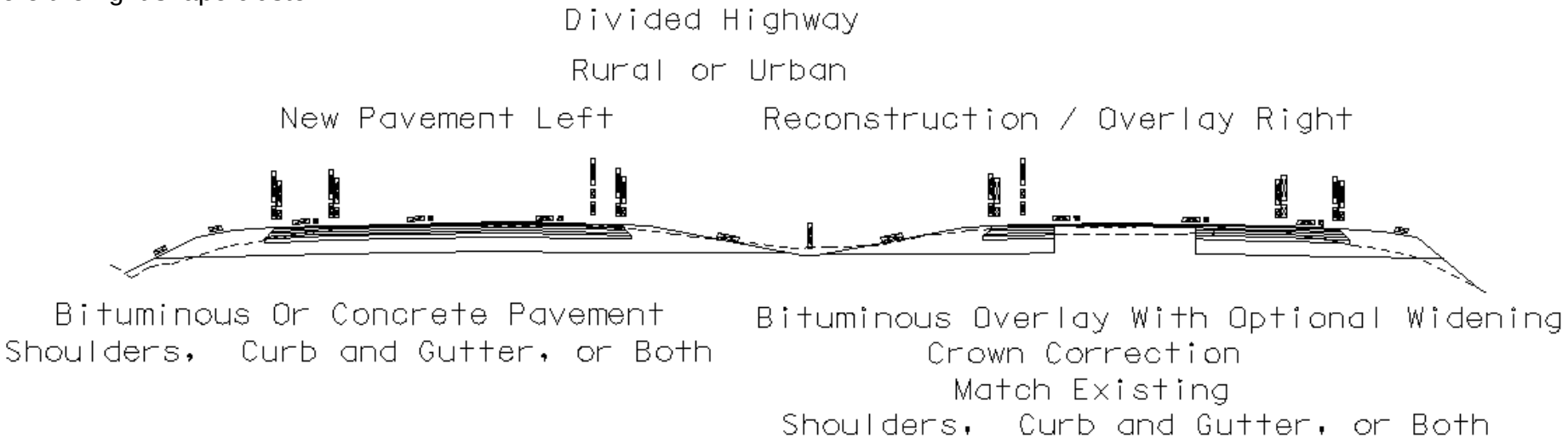
This typical draws cross sections for divided projects where the left side is new Pavement and the right side is Reconstruction. It works for both rural and urban sections or a combination of the two. For the left shape cluster, it draws both bituminous and concrete new pavement structure. For the right shape cluster, it draws up to two overlay layers and an optional widening with bituminous or concrete pavement using either a "match existing" or "crown correction" approach. It draws bituminous and concrete Pavement, Rural Shoulders, Curbing With Urban Shoulders (U1 & U2), Standard Side Slopes, and Special Ditches.

This typical section resolves rural and or urban Medians including stepped barrier and retaining wall medians. There are a total of seven types of medians to choose from. The detailed options are covered later in this document.

All dimensions are in master units of feet.

IMPORTANT: Set the proposed cross section run "Tolerance" value to 0.01. This is required for the criteria to work correctly.

IMPORTANT: Always include the proposed shape clusters in order from left to right. The left shape cluster should always be listed before the right shape cluster.



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Scanned Graphic Elements

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ELEMENT TYPE	DGN DRAWING FILE
Right of Way	Right of Way DGN
Reconstruction Existing Edge of Pavement	Existing TOPO DGN
Existing Ground	Cross-Section DGN
Saw Cut	Proposed Plan DGN
Pavement and Shoulder	Proposed Plan DGN
Curb and Gutter	Proposed Plan DGN
Curb	Proposed Plan DGN
Gutter	Proposed Plan DGN
Concrete Barrier Curb and Guardrail	Proposed Plan DGN
Roadside	Proposed Plan DGN
Side Slope and Drainage	GEOPAK Lines DGN

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The typical section uses the following globally define variables. Click on an individual variable for further information.

DGN File

Existing TOPO DGN
Right of Way DGN
Cross Section DGN
Proposed Plan DGN
GEOPAK Lines DGN

Tapers File

Left Tapers File Name
Right Tapers File Name

Plot Scale

XS Scale
Plan View Scale
Plan View Flow Arrow Scale

GPK Element

Survey Baseline Name
Left Special Ditch Profiles and Right Special Ditch Profiles
Left Ditch Alignment and Right Ditch Alignment
Left Match Line Profiles and Right Match Line Profiles
Left Sidewalk Profiles and Right Sidewalk Profiles
Left Interception Special Ditch Profiles and Right Interception Special Ditch Profiles
Median Ditch Profiles
Ramp Chain Names
Match Line Chain Names
Left Top of Wall Profiles and Right Top of Wall Profiles
Left Top of Footing Profiles and Right Top of Footing Profiles
Median Top of Footing Profiles

Redefinable Variables

The typical section uses the following redefinable variables, which can have different values within the same run based on station range or another parameter. Click on an individual variable for further information. They are listed in the order they have in the run dialog.

Right of Way Buffer Width:

_d_ROW_Buffer_Width

Pavement Structure

_s_PavementType
_d_NormalPavementSlope
_d_PavementLayer1Thick
_d_PavementLayer2Thick
_d_PavementLayer3Thick
_d_PavementLayer4Thick
_d_Aggbase1Thickness
_d_Aggbase2Thickness
_d_RockFillBaseThickness
_s_RockFillBaseDaylight
_s_RockFillBaseDaylightHSS
_d_CompensatingDepth

Underdrain

_s_DrawLeftUnderdrain
_s_DrawRightUnderdrain
_d_UnderdrainHeight
_d_UnderdrainWidth

Reconstruction

_s_OverlayType
_s_WideningSlope
_s_OverlayOffsetLocation
_d_OverlayThickness1
_d_OverlayThickness2

Outside Shoulder

_s_OutsideShoulderType
_d_OutsideShoulderWidth
_d_OutsideShoulderSearchDistance
_s_LabelShoulderElevations
_d_NormalOutsideShoulderSlope
_d_ShoulderLayer1Thick
_d_ShoulderLayer2Thick
_d_ShoulderLayer3Thick
_d_ShoulderLayer4Thick
_s_ExtensionSlope

Median

_s_MedianShoulderType
_d_MedianShoulderWidth
_d_MedianShoulderSearchDistance
_d_NormalMedianShoulderSlope
_s_MedianType
_d_MedianSlope1
_d_MedianSlope1Width
_d_MedianSlope2
_d_StdMedianDitchDepth
_d_MedianDitchWidth
_d_PavedMedianThickness
_d_MaxPavedMedianWidth

Curb and Gutter

_d_CurbSearchDistance
_d_IntegralCurbHeight
_s_GutterSlopeInSuper

U2 Shoulder

_d_U2ShoulderSearchDistance
_d_U2ShoulderSlope
_d_U2ShoulderAggbaseThickness
_d_U2ShoulderWidth
_d_U2ShoulderThickness

Berm and Sidewalk

_d_BermSlope_Left
_d_BermWidth_Left
_d_SidewalkSlope
_d_BermSlope_Right
_d_BermWidth_Right
_d_SidewalkThickness

Standard Ditch

_d_DitchForeSlope1_Left
_d_DitchForeSlope2_Left
_d_DitchWidth_Left
_d_DitchForeSlope1_Right
_d_DitchForeSlope2_Right
_d_DitchWidth_Right
_d_DitchForeSlope1Width_Left
_d_StandardDitchDepth_Left
_d_DitchBackSlope_Left
_d_DitchForeSlope1Width_Right
_d_StandardDitchDepth_Right
_d_DitchBackSlope_Right

Fill Slope

_d_FillSlope1_Left
_d_FillSlope1Width_Left
_d_FillSlope2_Left
_d_FillSlope1_Right
_d_FillSlope1Width_Right
_d_FillSlope2_Right

Force Closed Slope

_s_LeftForceClosingSlopes
_d_LeftForcedCutSlope
_d_RightForcedCutSlope
_s_RightForceClosingSlopes
_d_LeftForcedFillSlope
_d_RightForcedFillSlope

Right of Way Constrained Slope

_s_LeftROWConstrainedSlope
_s_RightROWConstrainedSlope

Special Ditch Label:

_s_SpecialDitchLabel

Draw Ditches in Plan View:

_s_DrawDitchesInPlanView

Rock Benching

_d_BenchingBackSlope
_d_BenchWidth
_d_BenchHeight
_s_TopBenchWidth

Chain Search Distance

_d_RampChainSearchDistance
_d_MatchLineChainSearchDistance

Entrance

_d_EntrancePadWidth
_d_EntranceVertCurveLength
_d_Max_Type1_Driveway_Slope
_d_Max_Type1_Roll_Over_Slope
_d_Max_Type2_Driveway_Slope
_d_Max_Type2_Roll_Over_Slope
_d_Max_Type3_Driveway_Slope
_d_Max_Type3_Roll_Over_Slope
_d_Max_Type4_Driveway_Slope
_d_Max_Type4_Roll_Over_Slope
_d_Max_Type5_Driveway_Slope
_d_Max_Type5_Roll_Over_Slope

Retaining Wall

_d_DepthBelowProposedGroundInCut
_d_HeightAboveExistGroundInCut
_d_DepthBelowExistGroundInFill
_d_HeightAbovePropGroundInFill
_d_WallWidth
_s_WallHeight
_d_BackWallHeightInCut
_d_BackFootingWidth
_d_TotalFootingWidth
_d_FootingThickness
_d_KeyOffset
_d_KeyWidth
_d_KeyHeight
_d_AdjacentWallSearchDistance

Levee and Interception Ditch

_s_LeveeAdjacentToDitch
_d_LeveeHeight
_d_LeveeForeslope
_d_LeveeBackslope
_d_InterceptionDitchWidth
_d_InterceptionDitchBackslope

Non-Standard Curb and Gutter

_d_GutterSlope
_d_GutterWidth
_d_CurbFaceWidth
_d_TopCurbWidth
_d_CurbHeight
_d_GutterThickness
_d_GutterBaseSlope

New Construction Right And Reconstruction Left Typical Section (NRtRLt)

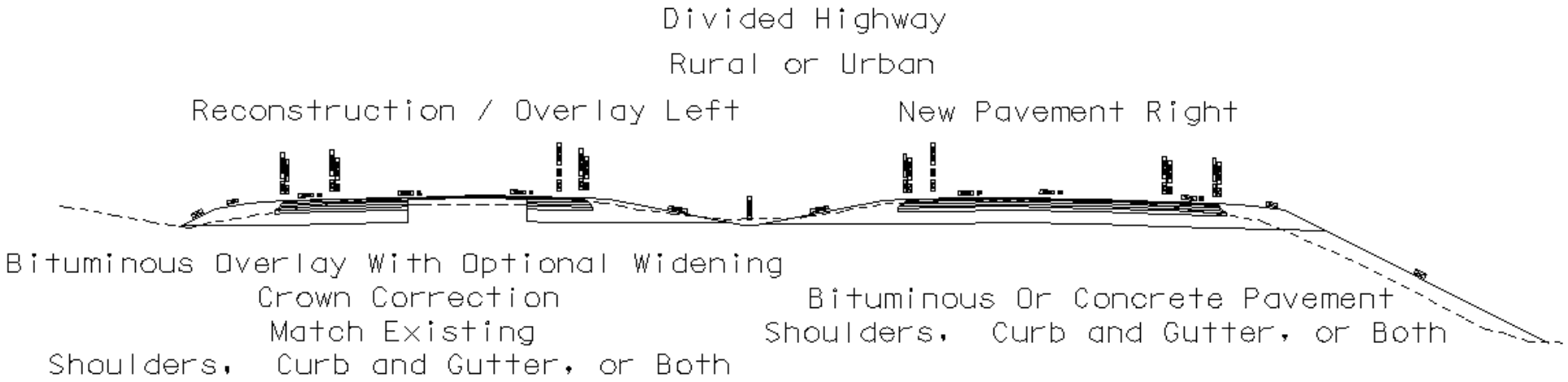
This typical draws cross sections for divided projects where the right side is new Pavement and the left side is Reconstruction. It works for both rural and urban sections or a combination of both. For the right shape cluster, it draws both bituminous and concrete new pavement structure. For the left shape cluster, it draws up to two overlay layers and an optional widening with bituminous or concrete pavement using either a "match existing" or "crown correction" approach. It draws bituminous and concrete Pavement, Rural Shoulders, Curbing With Urban Shoulders (U1 & U2), Standard Side Slopes, and Special Ditches.

This typical section resolves rural and or urban Medians including stepped barrier and retaining wall medians. There are a total of seven types of medians to choose from. The detailed options are covered later in this document.

All dimensions are in master units of feet.

IMPORTANT: Set the proposed cross section run "Tolerance" value to 0.01. This is required for the criteria to work correctly.

IMPORTANT: Always include the proposed shape clusters in order from left to right. The left shape cluster should always be listed before the right shape cluster.



The rest of this section lists the scanned graphic elements, globally defined variables, and redefinable variables used by this typical section. The appendices, which can be reached through the links in the Table of Contents, give additional information.

Scanned Graphic Elements

The typical section scans design file for the following types of graphic elements. Click on an individual type to find out information about which Design and Computation Manager item is used for each item.

ELEMENT TYPE	DGN DRAWING FILE
Right of Way	Right of Way DGN
Reconstruction Existing Edge of Pavement	Existing TOPO DGN
Existing Ground	Cross-Section DGN
Saw Cut	Proposed Plan DGN
Pavement and Shoulder	Proposed Plan DGN
Curb and Gutter	Proposed Plan DGN
Curb	Proposed Plan DGN
Gutter	Proposed Plan DGN
Concrete Barrier Curb and Guardrail	Proposed Plan DGN
Roadside	Proposed Plan DGN
Side Slope and Drainage	GEOPAK Lines DGN

IF ANY OF THE ABOVE TYPES OF ELEMENTS DO NOT APPLY TO YOUR JOB YOU MUST STILL SPECIFY A VALID DESIGN FILE OR ELSE AN ERROR WILL OCCUR. THE CRITERIA FILES WILL NOT PROCESS AN ELEMENT IF IT DOESN'T EXIST.

DEFINE VARIABLES

The typical section uses the following globally define variables. Click on an individual variable for further information.

DGN File

Existing TOPO DGN
Right of Way DGN
Cross Section DGN
Proposed Plan DGN
GEOPAK Lines DGN

Tapers File

Left Tapers File Name
Right Tapers File Name

Plot Scale

XS Scale
Plan View Scale
Plan View Flow Arrow Scale

GPK Element

Survey Baseline Name
Left Special Ditch Profiles and Right Special Ditch Profiles
Left Ditch Alignment and Right Ditch Alignment
Left Match Line Profiles and Right Match Line Profiles
Left Sidewalk Profiles and Right Sidewalk Profiles
Left Interception Special Ditch Profiles and Right Interception Special Ditch Profiles
Median Ditch Profiles
Ramp Chain Names
Match Line Chain Names
Left Top of Wall Profiles and Right Top of Wall Profiles
Left Top of Footing Profiles and Right Top of Footing Profiles
Median Top of Footing Profiles

Redefinable Variables

The typical section uses the following redefinable variables, which can have different values within the same run based on station range or another parameter. Click on an individual variable for further information. They are listed in the order they have in the run dialog.

Right of Way Buffer Width:

_d_ROW_Buffer_Width

Pavement Structure

_s_PavementType
_d_NormalPavementSlope
_d_PavementLayer1Thick
_d_PavementLayer2Thick
_d_PavementLayer3Thick
_d_PavementLayer4Thick
_d_Aggbase1Thickness
_d_Aggbase2Thickness
_d_RockFillBaseThickness
_s_RockFillBaseDaylight
_s_RockFillBaseDaylightHSS
_d_CompensatingDepth

Underdrain

_s_DrawLeftUnderdrain
_s_DrawRightUnderdrain
_d_UnderdrainHeight
_d_UnderdrainWidth

Reconstruction

_s_OverlayType
_s_WideningSlope
_s_OverlayOffsetLocation
_d_OverlayThickness1
_d_OverlayThickness2

Outside Shoulder

_s_OutsideShoulderType
_d_OutsideShoulderWidth
_d_OutsideShoulderSearchDistance
_s_LabelShoulderElevations
_d_NormalOutsideShoulderSlope
_d_ShoulderLayer1Thick
_d_ShoulderLayer2Thick
_d_ShoulderLayer3Thick
_d_ShoulderLayer4Thick
_s_ExtensionSlope

Median

_s_MedianShoulderType
_d_MedianShoulderWidth
_d_MedianShoulderSearchDistance
_d_NormalMedianShoulderSlope
_s_MedianType
_d_MedianSlope1
_d_MedianSlope1Width
_d_MedianSlope2
_d_StdMedianDitchDepth
_d_MedianDitchWidth
_d_PavedMedianThickness
_d_MaxPavedMedianWidth

Curb and Gutter

_d_CurbSearchDistance
_d_IntegralCurbHeight
_s_GutterSlopeInSuper

U2 Shoulder

_d_U2ShoulderSearchDistance
_d_U2ShoulderSlope
_d_U2ShoulderAggbaseThickness
_d_U2ShoulderWidth
_d_U2ShoulderThickness

Berm and Sidewalk

_d_BermSlope_Left
_d_BermWidth_Left
_d_SidewalkSlope
_d_BermSlope_Right
_d_BermWidth_Right
_d_SidewalkThickness

Standard Ditch

_d_DitchForeSlope1_Left
_d_DitchForeSlope2_Left
_d_DitchWidth_Left
_d_DitchForeSlope1_Right
_d_DitchForeSlope2_Right
_d_DitchWidth_Right
_d_DitchForeSlope1Width_Left
_d_StandardDitchDepth_Left
_d_DitchBackSlope_Left
_d_DitchForeSlope1Width_Right
_d_StandardDitchDepth_Right
_d_DitchBackSlope_Right

Fill Slope

_d_FillSlope1_Left
_d_FillSlope1Width_Left
_d_FillSlope2_Left
_d_FillSlope1_Right
_d_FillSlope1Width_Right
_d_FillSlope2_Right

Force Closed Slope

_s_LeftForceClosingSlopes
_d_LeftForcedCutSlope
_d_RightForcedCutSlope
_s_RightForceClosingSlopes
_d_LeftForcedFillSlope
_d_RightForcedFillSlope

Right of Way Constrained Slope

_s_LeftROWConstrainedSlope
_s_RightROWConstrainedSlope

Special Ditch Label:

_s_SpecialDitchLabel

Draw Ditches in Plan View:

_s_DrawDitchesInPlanView

Rock Benching

_d_BenchingBackSlope
_d_BenchWidth
_d_BenchHeight
_s_TopBenchWidth

Chain Search Distance

_d_RampChainSearchDistance
_d_MatchLineChainSearchDistance

Entrance

_d_EntrancePadWidth
_d_EntranceVertCurveLength
_d_Max_Type1_Driveway_Slope
_d_Max_Type1_Roll_Over_Slope
_d_Max_Type2_Driveway_Slope
_d_Max_Type2_Roll_Over_Slope
_d_Max_Type3_Driveway_Slope
_d_Max_Type3_Roll_Over_Slope
_d_Max_Type4_Driveway_Slope
_d_Max_Type4_Roll_Over_Slope
_d_Max_Type5_Driveway_Slope
_d_Max_Type5_Roll_Over_Slope

Retaining Wall

_d_DepthBelowProposedGroundInCut
_d_HeightAboveExistGroundInCut
_d_DepthBelowExistGroundInFill
_d_HeightAbovePropGroundInFill
_d_WallWidth
_s_WallHeight
_d_BackWallHeightInCut
_d_BackFootingWidth
_d_TotalFootingWidth
_d_FootingThickness
_d_KeyOffset
_d_KeyWidth
_d_KeyHeight
_d_AdjacentWallSearchDistance

Levee and Interception Ditch

_s_LeveeAdjacentToDitch
_d_LeveeHeight
_d_LeveeForeslope
_d_LeveeBackslope
_d_InterceptionDitchWidth
_d_InterceptionDitchBackslope

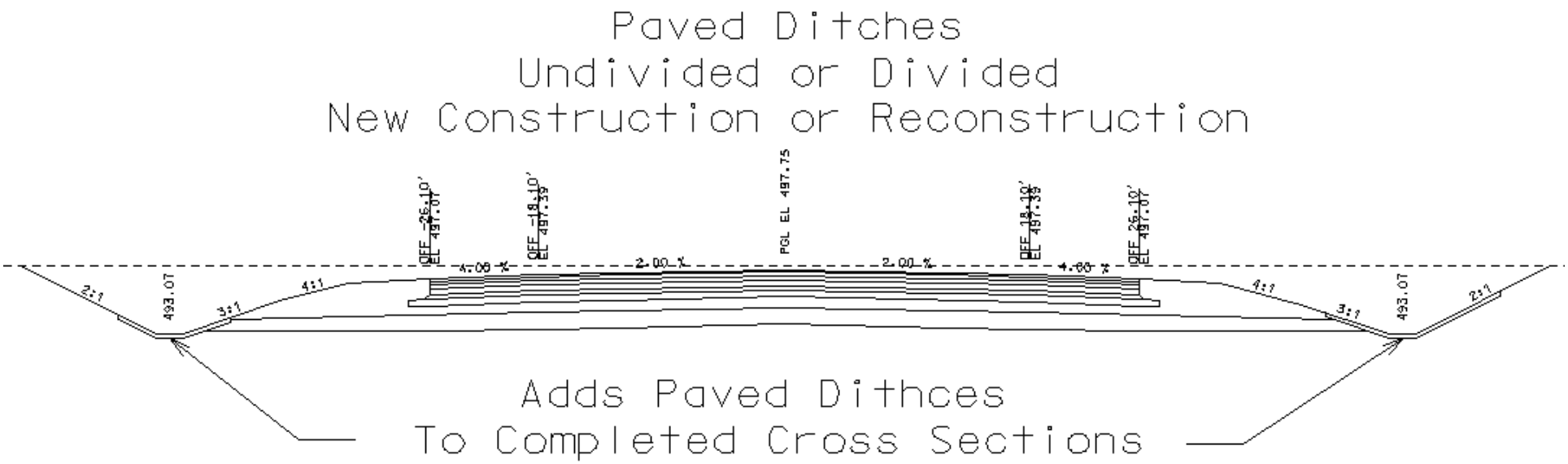
Non-Standard Curb and Gutter

_d_GutterSlope
_d_GutterWidth
_d_CurbFaceWidth
_d_TopCurbWidth
_d_CurbHeight
_d_GutterThickness
_d_GutterBaseSlope

Proposed Paved Ditches (PDitch)

This typical section searches the proposed plan view for pairs of lines designating locations of paved ditches. There are three requirements that must be met for this typical section to function. The proposed cross sections except for the paved ditches must be completed. Secondly, the inside and outside edges of the paved ditch must be drawn in the proposed plan view. Lastly, there must be an even number of edges of paved ditches drawn. No ditches are drawn if an odd number of plan view paved ditch edges are found crossing the pattern line for the current cross section.

IMPORTANT: Set the proposed cross section run "Tolerance" value to 0.01. This is required for the criteria to work correctly.



The rest of this section lists the scanned graphic elements, globally defined variables, and redefinable variable used by this typical section. The appendices, which can be reached through the links in the Table of Contents, give additional information.

Scanned Graphic Elements

The typical section scans a design file for the following types of graphic elements. Click on an individual type to find out information about which Design and Computation Manager item is used for each item.

ELEMENT TYPE	DGN DRAWING FILE
Paved Ditch	Proposed Plan DGN and Cross Section DGN

IF ANY OF THE ABOVE TYPES OF ELEMENTS DO NOT APPLY TO YOUR JOB YOU MUST STILL SPECIFY A VALID DESIGN FILE OR ELSE AN ERROR WILL OCCUR. THE CRITERIA FILES WILL NOT PROCESS AN ELEMENT IF IT DOESN'T EXIST.

DEFINE VARIABLES

The typical section uses the following globally define variables. Click on an individual variable for further information.

DGN File

Cross Section DGN
Proposed Plan DGN

Redefinable Variables

The typical section uses the following redefinable variable, which can have different values within the same run based on station range or another parameter.

Proposed Paved Ditch Thickness

This is the total thickness of the proposed paved ditches from the top of proposed ground to the bottom of the paved ditch.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_PavedDitchThickness = 6/12
    }
```

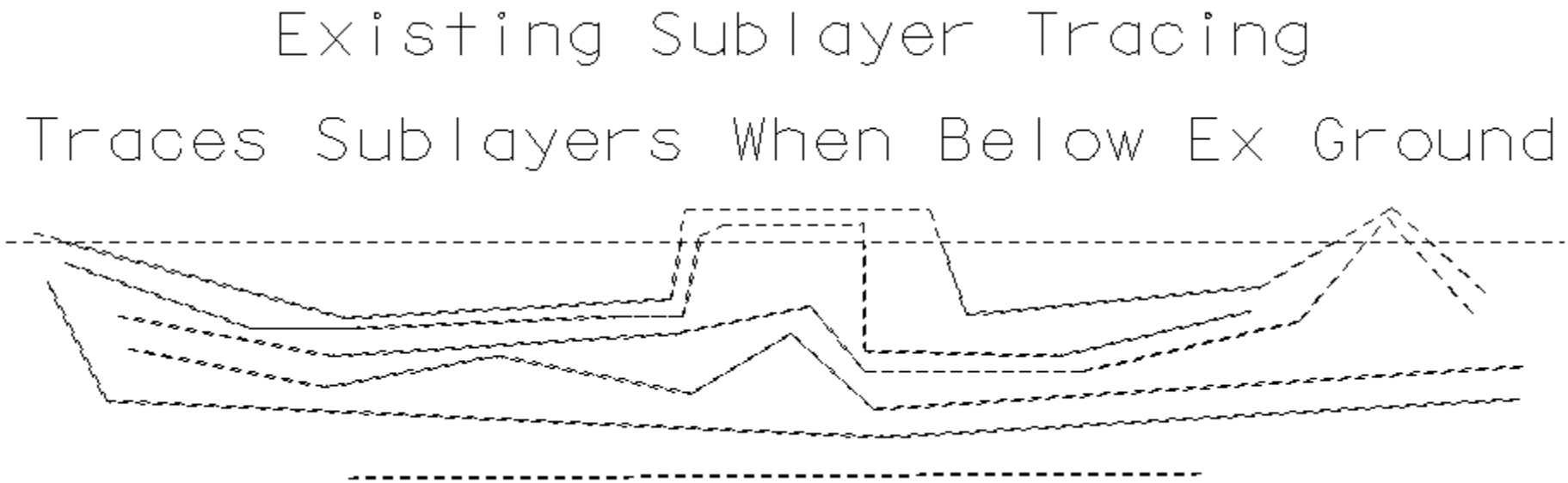
Trace Existing Sub Layers (SubLay)

This typical section traces the existing sub layers while the sub layer is below existing ground. This is necessary when the sub layers were generated from a digital terrain model and some of the sub layer lines are drawn above the existing ground line in the cross section view. It draws a new line on top of the existing sub layer but it will only draw the line while the sub layer remains below the existing ground. Once these new lines are drawn, the original sub layer lines can be deleted and the newly generated lines can be utilized for earthwork purposes. The following sub layers are searched and traced if present:

Top of Rock	Sub Layer 1	Sub Layer 3
Unsuitable Material	Sub Layer 2	Sub Layer 4

The typical section also optionally draws a top of rock line 100 feet below existing ground on those cross sections without a top of rock line when the line is present on only some of the cross sections.

IMPORTANT: Set the proposed cross section run "Tolerance" value to 0.01. This is required for the criteria to work correctly.



The rest of this section lists the scanned graphic elements, globally defined variable, and redefinable variable used by this typical section. The appendices, which can be reached through the links in the Table of Contents, give additional information.

Scanned Graphic Elements

The typical section scans a design file for the following types of graphic elements. Click on an individual type to find out information about which Design and Computation Manager item is used for each item.

ELEMENT TYPE	DGN DRAWING FILE
Existing Ground	Cross Section DGN
Special Sub Layers	Cross Section DGN

IF ANY OF THE ABOVE TYPES OF ELEMENTS DO NOT APPLY TO YOUR JOB YOU MUST STILL SPECIFY A VALID DESIGN FILE OR ELSE AN ERROR WILL OCCUR. THE CRITERIA FILES WILL NOT PROCESS AN ELEMENT IF IT DOESN'T EXIST.

DEFINE VARIABLES

The typical section uses the following globally define variable. Click on it for further information.

DGN File

Cross Section DGN

Redefinable Variables

The typical section uses the following redefinable variable, which can have different values within the same run based on station range or another parameter.

Draw Top of Rock

Controls whether to draw the top of rock line when no top of rock is found on the current cross section. This has been implemented to allow the user to run earthwork when rock is present on some, but not all, of the cross sections. If rock is to be considered, a top of rock line must reside on ALL cross sections. If the variable is set to ^Yes^ and a rock line is NOT found on a section, a top of rock line will be drawn 100 feet below the existing ground. The options are ^Yes^ or ^No^. The carets "^" are required.

EXAMPLE:

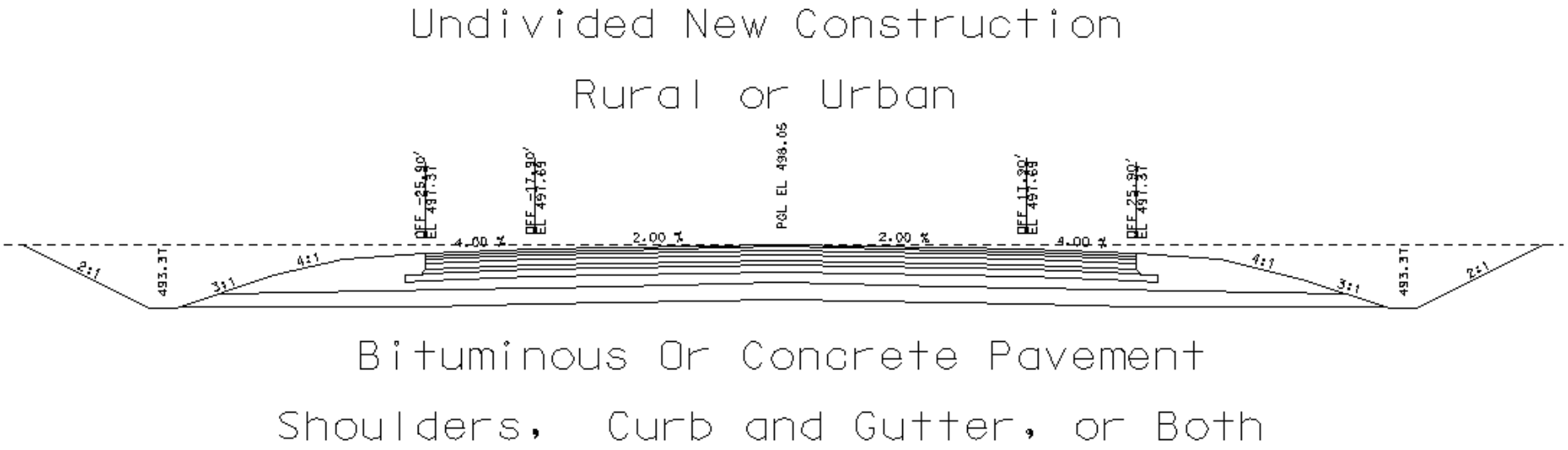
```
if (Sta >= 0+00 R 1)
    {
        _s_DrawRockLine = ^Yes^
    }
```

Undivided New Pavement Typical Section (UNPavt)

This typical section draws proposed cross sections for undivided new pavement projects. It works for both rural and urban sections, or a combination of the two. It draws bituminous and concrete Pavement, Rural Shoulders, Curbing With Urban Shoulders (U1 & U2), Standard Side Slopes, and Special Ditches.

This typical section is for new construction only. All dimensions are in master units of feet.

IMPORTANT: Set the proposed cross section run "Tolerance" value to 0.01. This is required for the criteria to work correctly.



The rest of this section lists the scanned graphic elements, globally defined variables, and redefinable variables used by this typical section. The appendices, which can be reached through the links in the Table of Contents, give additional information.

Scanned Graphic Elements

The typical section scans design file for the following types of graphic elements. Click on an individual type to find out information about which Design and Computation Manager item is used for each item.

ELEMENT TYPE	DGN DRAWING FILE
Right of Way	Right of Way DGN
Existing Ground	Cross-Section DGN
Pavement and Shoulder	Proposed Plan DGN
Curb and Gutter	Proposed Plan DGN
Curb	Proposed Plan DGN
Gutter	Proposed Plan DGN
Concrete Barrier Curb and Guardrail	Proposed Plan DGN
Roadside	Proposed Plan DGN
Side Slope and Drainage	GEOPAK Lines DGN

IF ANY OF THE ABOVE TYPES OF ELEMENTS DO NOT APPLY TO YOUR JOB YOU MUST STILL SPECIFY A VALID DESIGN FILE OR ELSE AN ERROR WILL OCCUR. THE CRITERIA FILES WILL NOT PROCESS AN ELEMENT IF IT DOESN'T EXIST.

DEFINE VARIABLES

The typical section uses the following globally define variables. Click on an individual variable for further information.

DGN File

Right of Way DGN
Cross Section DGN
Proposed Plan DGN
GEOPAK Lines DGN

Tapers File

Left Tapers File Name
Right Tapers File Name

Plot Scale

XS Scale
Plan View Scale
Plan View Flow Arrow Scale

GPK Element

Survey Baseline Name
Left Special Ditch Profiles and Right Special Ditch Profiles
Left Ditch Alignment and Right Ditch Alignment
Left Match Line Profiles and Right Match Line Profiles
Left Sidewalk Profiles and Right Sidewalk Profiles
Left Interception Special Ditch Profiles and Right Interception Special Ditch Profiles
Ramp Chain Names
Match Line Chain Names
Left Top of Wall Profiles and Right Top of Wall Profiles
Left Top of Footing Profiles and Right Top of Footing Profiles

Redefinable Variables

The typical section uses the following redefinable variables, which can have different values within the same run based on station range or another user-defined parameter. Click on an individual variable for further information. They are listed in the order they have in the run dialog box.

Right of Way Buffer Width:

_d_ROW_Buffer_Width

Pavement Structure

_s_PavementType
_d_NormalPavementSlope
_d_PavementLayer1Thick
_d_PavementLayer2Thick
_d_PavementLayer3Thick
_d_PavementLayer4Thick
_d_Aggbase1Thickness
_d_Aggbase2Thickness
_d_RockFillBaseThickness
_s_RockFillBaseDaylight
_s_RockFillBaseDaylightHSS
_d_CompensatingDepth

Underdrain

_s_DrawLeftUnderdrain
_s_DrawRightUnderdrain
_d_UnderdrainHeight
_d_UnderdrainWidth

Outside Shoulder

_s_OutsideShoulderType
_d_OutsideShoulderWidth
_d_OutsideShoulderSearchDistance
_s_LabelShoulderElevations
_d_NormalOutsideShoulderSlope
_d_ShoulderLayer1Thick
_d_ShoulderLayer2Thick
_d_ShoulderLayer3Thick
_d_ShoulderLayer4Thick
_s_ExtensionSlope

Curb and Gutter

_d_CurbSearchDistance
_d_IntegralCurbHeight
_s_GutterSlopeInSuper

U2 Shoulder

_d_U2ShoulderSearchDistance
_d_U2ShoulderWidth
_d_U2ShoulderSlope
_d_U2ShoulderThickness
_d_U2ShoulderAggbaseThickness

Berm and Sidewalk

_d_BermSlope_Left
_d_BermSlope_Right
_d_BermWidth_Left
_d_BermWidth_Right
_d_SidewalkSlope
_d_SidewalkThickness

Standard Ditch

_d_DitchForeSlope1_Left
_d_DitchForeSlope1_Right
_d_DitchForeSlope1Width_Left
_d_DitchForeSlope1Width_Right
_d_DitchForeSlope2_Left
_d_DitchForeSlope2_Right
_d_StandardDitchDepth_Left
_d_StandardDitchDepth_Right
_d_DitchWidth_Left
_d_DitchWidth_Right
_d_DitchBackSlope_Left
_d_DitchBackSlope_Right

Fill Slope

_d_FillSlope1_Left
_d_FillSlope1_Right
_d_FillSlope1Width_Left
_d_FillSlope1Width_Right
_d_FillSlope2_Left
_d_FillSlope2_Right

Force Closed Slope

_s_LeftForceClosingSlopes
_s_RightForceClosingSlopes
_d_LeftForcedCutSlope
_d_LeftForcedFillSlope
_d_RightForcedCutSlope
_d_RightForcedFillSlope

Right of Way Constrained Slope

_s_LeftROWConstrainedSlope
_s_RightROWConstrainedSlope

Special Ditch Label:

_s_SpecialDitchLabel

Draw Ditches in Plan View:

_s_DrawDitchesInPlanView

Rock Benching

_d_BenchingBackSlope
_d_BenchWidth
_d_BenchHeight
_s_TopBenchWidth

Chain Search Distance

_d_RampChainSearchDistance
_d_MatchLineChainSearchDistance

Entrance

_d_EntrancePadWidth
_d_EntranceVertCurveLength
_d_Max_Type1_Driveway_Slope
_d_Max_Type1_Roll_Over_Slope
_d_Max_Type2_Driveway_Slope
_d_Max_Type2_Roll_Over_Slope
_d_Max_Type3_Driveway_Slope
_d_Max_Type3_Roll_Over_Slope
_d_Max_Type4_Driveway_Slope
_d_Max_Type4_Roll_Over_Slope
_d_Max_Type5_Driveway_Slope
_d_Max_Type5_Roll_Over_Slope

Retaining Wall

_d_DepthBelowProposedGroundInCut
_d_HeightAboveExistGroundInCut
_d_DepthBelowExistGroundInFill
_d_HeightAbovePropGroundInFill
_d_WallWidth
_s_WallHeight
_d_BackWallHeightInCut
_d_BackFootingWidth
_d_TotalFootingWidth
_d_FootingThickness
_d_KeyOffset
_d_KeyWidth
_d_KeyHeight
_d_AdjacentWallSearchDistance

Levee and Interception Ditch

_s_LeveeAdjacentToDitch
_d_LeveeHeight
_d_LeveeForeslope
_d_LeveeBackslope
_d_InterceptionDitchWidth
_d_InterceptionDitchBackslope

Non-Standard Curb and Gutter

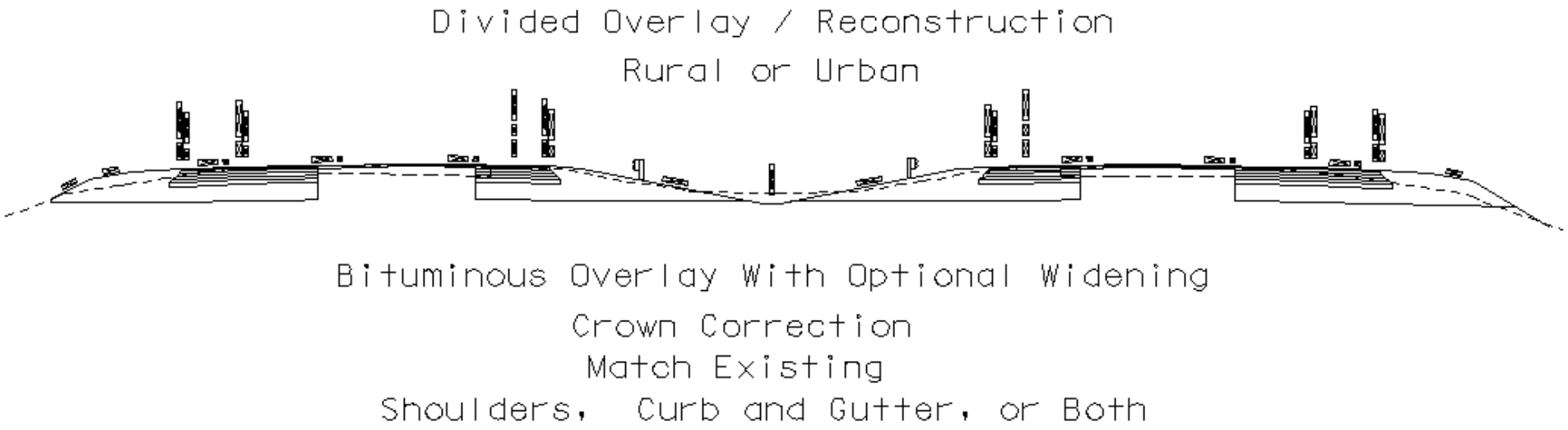
_d_GutterSlope
_d_GutterWidth
_d_CurbFaceWidth
_d_TopCurbWidth
_d_CurbHeight
_d_GutterThickness
_d_GutterBaseSlope

Undivided Reconstruction Typical Section (URECon)

This typical section draws proposed cross sections for undivided Reconstruction projects. It works for both rural and urban sections or a combination of the two. It draws up to two overlay layers and an optional widening with bituminous or concrete Pavement using either a "match existing" or "crown correction" approach. It draws bituminous and concrete Pavement, Rural Shoulders, Curbing With Urban Shoulders (U1 & U2), Standard Side Slopes, and Special Ditches.

This typical section is for reconstruction only. All dimensions are in master units of feet.

IMPORTANT: Set the proposed cross section run "Tolerance" value to 0.01. This is required for the criteria to work correctly.



The rest of this section lists the scanned graphic elements, globally defined variables, and redefinable variables used by this typical section. The appendices, which can be reached through the links in the Table of Contents, give additional information.

Scanned Graphic Elements

The typical section scans design file for the following types of graphic elements. Click on an individual type to find out information about which Design and Computation Manager item is used for each item.

ELEMENT TYPE	DGN DRAWING FILE
Right of Way	Right of Way DGN
Reconstruction Existing Edge of Pavement	Existing TOPO DGN
Existing Ground	Cross-Section DGN
Saw Cut	Proposed Plan DGN
Pavement and Shoulder	Proposed Plan DGN
Curb and Gutter	Proposed Plan DGN
Curb	Proposed Plan DGN
Gutter	Proposed Plan DGN
Concrete Barrier Curb and Guardrail	Proposed Plan DGN
Roadside	Proposed Plan DGN
Side Slope and Drainage	GEOPAK Lines DGN

IF ANY OF THE ABOVE TYPES OF ELEMENTS DO NOT APPLY TO YOUR JOB YOU MUST STILL SPECIFY A VALID DESIGN FILE OR ELSE AN ERROR WILL OCCUR. THE CRITERIA FILES WILL NOT PROCESS AN ELEMENT IF IT DOESN'T EXIST.

DEFINE VARIABLES

The typical section uses the following globally define variables. Click on an individual variable for further information.

DGN File

Existing TOPO DGN
Right of Way DGN
Cross Section DGN
Proposed Plan DGN
GEOPAK Lines DGN

Tapers File

Left Tapers File Name
Right Tapers File Name

Plot Scale

XS Scale
Plan View Scale
Plan View Flow Arrow Scale

GPK Element

Survey Baseline Name
Left Special Ditch Profiles and Right Special Ditch Profiles
Left Ditch Alignment and Right Ditch Alignment
Left Match Line Profiles and Right Match Line Profiles
Left Sidewalk Profiles and Right Sidewalk Profiles
Left Interception Special Ditch Profiles and Right Interception Special Ditch Profiles
Ramp Chain Names
Match Line Chain Names
Left Top of Wall Profiles and Right Top of Wall Profiles
Left Top of Footing Profiles and Right Top of Footing Profiles

Redefinable Variables

The typical section uses the following redefinable variables, which can have different values within the same run based on station range or another parameter. Click on an individual variable for further information. They are listed in the order they have in the run dialog.

Right of Way Buffer Width:

_d_ROW_Buffer_Width

Pavement Structure

_s_PavementType
_d_NormalPavementSlope
_d_PavementLayer1Thick
_d_PavementLayer2Thick
_d_PavementLayer3Thick
_d_PavementLayer4Thick
_d_Aggbase1Thickness
_d_Aggbase2Thickness
_d_RockFillBaseThickness
_s_RockFillBaseDaylight
_s_RockFillBaseDaylightHSS
_d_CompensatingDepth

Underdrain

_s_DrawLeftUnderdrain
_s_DrawRightUnderdrain
_d_UnderdrainHeight
_d_UnderdrainWidth

Reconstruction

_s_OverlayType
_s_WideningSlope
_s_OverlayOffsetLocation
_d_OverlayThickness1
_d_OverlayThickness2

Outside Shoulder

_s_OutsideShoulderType
_d_OutsideShoulderWidth
_d_OutsideShoulderSearchDistance
_s_LabelShoulderElevations
_d_NormalOutsideShoulderSlope
_d_ShoulderLayer1Thick
_d_ShoulderLayer2Thick
_d_ShoulderLayer3Thick
_d_ShoulderLayer4Thick
_s_ExtensionSlope

Curb and Gutter

_d_CurbSearchDistance
_d_IntegralCurbHeight
_s_GutterSlopeInSuper

U2 Shoulder

_d_U2ShoulderSearchDistance
_d_U2ShoulderWidth
_d_U2ShoulderSlope
_d_U2ShoulderThickness
_d_U2ShoulderAggbaseThickness

Berm and Sidewalk

_d_BermSlope_Left
_d_BermSlope_Right
_d_BermWidth_Left
_d_BermWidth_Right
_d_SidewalkSlope
_d_SidewalkThickness

Standard Ditch

_d_DitchForeSlope1_Left
_d_DitchForeSlope1_Right
_d_DitchForeSlope1Width_Left
_d_DitchForeSlope1Width_Right
_d_DitchForeSlope2_Left
_d_DitchForeSlope2_Right
_d_StandardDitchDepth_Left
_d_StandardDitchDepth_Right
_d_DitchWidth_Left
_d_DitchWidth_Right
_d_DitchBackSlope_Left
_d_DitchBackSlope_Right

Fill Slope

_d_FillSlope1_Left
_d_FillSlope1_Right
_d_FillSlope1Width_Left
_d_FillSlope1Width_Right
_d_FillSlope2_Left
_d_FillSlope2_Right

Force Closed Slope

_s_LeftForceClosingSlopes
_s_RightForceClosingSlopes
_d_LeftForcedCutSlope
_d_LeftForcedFillSlope
_d_RightForcedCutSlope
_d_RightForcedFillSlope

Right of Way Constrained Slope

_s_LeftROWConstrainedSlope
_s_RightROWConstrainedSlope

Special Ditch Label:

_s_SpecialDitchLabel

Draw Ditches in Plan View:

_s_DrawDitchesInPlanView

Rock Benching

_d_BenchingBackSlope
_d_BenchWidth
_d_BenchHeight
_s_TopBenchWidth

Chain Search Distance

_d_RampChainSearchDistance
_d_MatchLineChainSearchDistance

Entrance

_d_EntrancePadWidth
_d_EntranceVertCurveLength
_d_Max_Type1_Driveway_Slope
_d_Max_Type1_Roll_Over_Slope
_d_Max_Type2_Driveway_Slope
_d_Max_Type2_Roll_Over_Slope
_d_Max_Type3_Driveway_Slope
_d_Max_Type3_Roll_Over_Slope
_d_Max_Type4_Driveway_Slope
_d_Max_Type4_Roll_Over_Slope
_d_Max_Type5_Driveway_Slope
_d_Max_Type5_Roll_Over_Slope

Retaining Wall

_d_DepthBelowProposedGroundInCut
_d_HeightAboveExistGroundInCut
_d_DepthBelowExistGroundInFill
_d_HeightAbovePropGroundInFill
_d_WallWidth
_s_WallHeight
_d_BackWallHeightInCut
_d_BackFootingWidth
_d_TotalFootingWidth
_d_FootingThickness
_d_KeyOffset
_d_KeyWidth
_d_KeyHeight
_d_AdjacentWallSearchDistance

Levee and Interception Ditch

_s_LeveeAdjacentToDitch
_d_LeveeHeight
_d_LeveeForeslope
_d_LeveeBackslope
_d_InterceptionDitchWidth
_d_InterceptionDitchBackslope

Non-Standard Curb and Gutter

_d_GutterSlope
_d_GutterWidth
_d_CurbFaceWidth
_d_TopCurbWidth
_d_CurbHeight
_d_GutterThickness
_d_GutterBaseSlope

Appendix 1 Scanned Graphic Elements

The criteria search for the following graphic elements in design files. They are grouped in categories based on how the elements are used so that you may be able to find the information quickly without having to look at each individual entry. These elements must be drawn in the designated file using the Design and Computation Manager item shown in the D&C Path list for each element.

Right of Way

Used by Draw Right of Way Lines (DrwROW) & all pavement typ. sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

ELEMENT	DGN DRAWING FILE	REQUIREMENT
Existing Right of Way D&C Path = Design Standards/RW/RW Line Exist	Right of Way DGN	Optional
Existing Right of Way Temporary Access D&C Path = Design Standards/RW/RW Temp Acc Ex	Right of Way DGN	Optional
Existing Right of Way Controlled Access D&C Path = Design Standards/RW/RW Cont Acc Ex	Right of Way DGN	Optional
Existing Right of Way No Right of Access D&C Path = Design Standards/RW/RW No Rt Ac Ex	Right of Way DGN	Optional
Proposed Right of Way D&C Path = Design Standards/RW/RW Line New	Right of Way DGN	Optional
Proposed Right of Way Temporary Access D&C Path = Design Standards/RW/RW Temp Access	Right of Way DGN	Optional
Proposed Right of Way Controlled Access D&C Path = Design Standards/RW/RW Cont Access	Right of Way DGN	Optional
Proposed Right of Way No Right of Access D&C Path = Design Standards/RW/RW No Rt Access	Right of Way DGN	Optional
Proposed Right of Way Permanent Easement D&C Path = Design Standards/RW/Easement Perm	Right of Way DGN	Optional
Proposed Right of Way Temporary Easement D&C Path = Design Standards/RW/Easement Temp	Right of Way DGN	Optional

Reconstruction Existing Edge of Pavement

Used by reconstruction pavement typical sections (DRecon, NLtRRt, NRtRLt, & URECon).

ELEMENT	DGN DRAWING FILE	REQUIREMENT
Existing Edge of Pavement D&C Path = Design Standards/Roadway/EOP Existing	Existing Topo DGN	**Required**

Draw Existing Features

Used by Existing Features typical section (ExFeat).

ELEMENT	DGN DRAWING FILE	REQUIREMENT	Link
Existing Edge of Pavement D&C Path = Design Standards/Roadway/EOP Existing	Existing Topo DGN	Optional	Appendix 6 Reconstruction Existing Pavement
Existing Paved Shoulder D&C Path = Design Standards/Roadway/EOS Existing	Existing Topo DGN	Optional	Existing Paved Shoulder
Existing Sidewalk D&C Path = Design Standards/Roadside/Sidewalk Exist	Existing Topo DGN	Optional	Existing Sidewalks
Existing Paved Ditch D&C Path = Design Standards/Drainage/Paved Ditch Ex	Existing Topo DGN	Optional	Existing Paved Ditches
Existing Paved Surface D&C Path = Design Standards/Roadway/Edge of Surface	Existing Topo DGN	Optional	Existing Paved Surfaces
Existing Building D&C Path = Design Standards/Property/Building	Existing Topo DGN	Optional	Existing Buildings
Existing Railroad D&C Path = Design Standards/Utilities/Railroad Track	Existing Topo DGN	Optional	Existing Railroads
Existing Wall D&C Path = Design Standards/Safety and Structures/Exist Retaining	Existing Topo DGN	Optional	Existing Wall
Existing Curb D&C Path = Design Standards/Roadway/Curb Existing	Existing Topo DGN	Optional	Existing Curb and Gutter

Existing Ground

Used by Trace Existing Sub Layers (SubLay) & all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

ELEMENT	DGN DRAWING FILE	REQUIREMENT
Existing Ground D&C Path = Design Standards/Cross Sections/Existing Surfaces/Ground Existing	Cross-Section DGN	**Required**
Existing Top of Rock D&C Path = Design Standards/Cross Sections/Existing Surfaces/Rock Top	Cross-Section DGN	Optional
Existing Bottom of Rock D&C Path = Design Standards/Cross Sections/Existing Surfaces/Rock Bottom	Cross-Section DGN	Optional

Special Sub Layers

Used by Trace Existing Sub Layers typical section (SubLay).

	DGN DRAWING FILE	REQUIREMENT
Existing Sublayer 1 D&C Path = Design Standards/Cross Sections/Existing Surfaces/Sub Layer 1	Cross-Section DGN	Optional
Existing Sublayer 2 D&C Path = Design Standards/Cross Sections/Existing Surfaces/Sub Layer 2	Cross-Section DGN	Optional
Existing Sublayer 3 D&C Path = Design Standards/Cross Sections/Existing Surfaces/Sub Layer 3	Cross-Section DGN	Optional
Existing Sublayer 4 D&C Path = Design Standards/Cross Sections/Existing Surfaces/Sub Layer 4	Cross-Section DGN	Optional

Saw Cut

Used by reconstruction pavement typical sections (DRecon, NLtRRt, NRtRLt, & URECon).

Go to: Appendix 6 Reconstruction

ELEMENT	DGN DRAWING FILE	REQUIREMENT
Proposed Saw Cut D&C Path = Design Standards/Roadway/Saw Cut	Proposed Plan DGN	Optional

Pavement and Shoulder

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

ELEMENT	DGN DRAWING FILE	REQUIREMENT	Link
Edge of Pavement D&C Path = Design Standards/Roadway/EOP New	Proposed Plan DGN	**Required**	Pavement Details
Concrete Shoulder D&C Path = Design Standards/Roadway/EOS New Conc.	Proposed Plan DGN	Optional	
Bituminous Shoulder D&C Path = Design Standards/Roadway/EOS New Asph.	Proposed Plan DGN	Optional	
Aggregate Shoulder D&C Path = Design Standards/Roadway/EOS New Aggr.	Proposed Plan DGN	Optional	
Earth Shoulder D&C Path = Design Standards/Roadway/EOS New Earth	Proposed Plan DGN	Optional	
U2 Earth Shoulder D&C Path = Design Standards/Roadway/EOS U2 Earth	Proposed Plan DGN	Optional	
U2 Bituminous Shoulder D&C Path = Design Standards/Roadway/EOS U2 Asphalt	Proposed Plan DGN	Optional	

Curb and Gutter

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

ELEMENT	DGN DRAWING FILE	REQUIREMENT	Link
Curb & Gutter Type A D&C Path = Payitems/Roadway/Curb/609-10.51	Proposed Plan DGN	Optional	Curb & Gutter Details
Curb & Gutter Type B D&C Path = Payitems/Roadway/Curb/609-10.52	Proposed Plan DGN	Optional	Curb & Gutter Details

Curb

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

ELEMENT	DGN DRAWING FILE	REQUIREMENT	Link
Concrete Curb Type S 6 Inch And Under D&C Path = Payitems/Roadway/Curb/609-10.10	Proposed Plan DGN	Optional	Separated Curb Details
Concrete Curb Type S Over 6 Inch D&C Path = Payitems/Roadway/Curb/609-10.11	Proposed Plan DGN	Optional	Separated Curb Details
Integral Curb Type A 6 Inch And Under D&C Path = Payitems/Roadway/Curb/609-20.11	Proposed Plan DGN	Optional	Integral Curb Types A, M, O, and E
Integral Curb Type B 6 Inch And Under D&C Path = Payitems/Roadway/Curb/609-20.12	Proposed Plan DGN	Optional	Integral Curb Types B and N
Integral Curb Type M D&C Path = Payitems/Roadway/Curb/609-20.13	Proposed Plan DGN	Optional	Integral Curb Types A, M, O, and E
Integral Curb Type N D&C Path = Payitems/Roadway/Curb/609-20.14	Proposed Plan DGN	Optional	Integral Curb Types B and N
Integral Curb Type O D&C Path = Payitems/Roadway/Curb/609-20.15	Proposed Plan DGN	Optional	Integral Curb Types A, M, O, and E
Integral Curb Type A Over 6 Inch D&C Path = Payitems/Roadway/Curb/609-20.21	Proposed Plan DGN	Optional	Integral Curb Types A, M, O, and E
Integral Curb Type B Over 6 Inch D&C Path = Payitems/Roadway/Curb/609-20.22	Proposed Plan DGN	Optional	Integral Curb Types B and N
Low Profile Curb Type E D&C Path = Payitems/Roadway/Curb/609-20.31	Proposed Plan DGN	Optional	Integral Curb Types A, M, O, and E
Low Profile Curb Type F D&C Path = Payitems/Roadway/Curb/609-20.32	Proposed Plan DGN	Optional	Separated Curb Details

Gutter

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

ELEMENT	DGN DRAWING FILE	REQUIREMENT	Link
Gutter Type A D&C Path = Payitems/Roadway/Curb/609-10.41	Proposed Plan DGN	Optional	Gutter Details
Gutter Type B D&C Path = Payitems/Roadway/Curb/609-10.42	Proposed Plan DGN	Optional	Gutter Details

Concrete Barrier Curb and Guardrail

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

ELEMENT	DGN DRAWING FILE	REQUIREMENT
Concrete Traffic Barrier Type A D&C Path = Payitems/Safety/Barrier/617-10.00	Proposed Plan DGN	Optional
Concrete Traffic Barrier Type B D&C Path = Payitems/Safety/Barrier/617-20.00	Proposed Plan DGN	Optional
Concrete Traffic Barrier Type B Modified D&C Path = Payitems/Safety/Barrier/617-20.01	Proposed Plan DGN	Optional
Concrete Traffic Barrier Type C D&C Path = Payitems/Safety/Barrier/617-30.00	Proposed Plan DGN	Optional
Concrete Traffic Barrier Type D D&C Path = Payitems/Safety/Barrier/617-31.00	Proposed Plan DGN	Optional
Concrete Traffic Barrier Type D Modified D&C Path = Payitems/Safety/Barrier/617-31.01	Proposed Plan DGN	Optional
Guardrail D&C Path = Design Standards/Safety and Structures/Guardrail	Proposed Plan DGN	Optional

Roadside

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

ELEMENT	DGN DRAWING FILE	REQUIREMENT
Paved Private Approach w/ Adjoining C&G D&C Path = Design Standards/Roadway/Paved Private	Proposed Plan DGN	Optional
Sideroad Approach w/ Adjoining C&G D&C Path = Design Standards/Roadway/Paved	Proposed Plan DGN	Optional
Paved Private Approach No Adjoining C&G D&C Path = Design Standards/Roadway/Paved Private -	Proposed Plan DGN	Optional
Sideroad Approach No Adjoining C&G D&C Path = Design Standards/Roadway/Paved Sideroad	Proposed Plan DGN	Optional
Type 1 Driveway Back of Entrance D&C Path = Design Standards/Roadway/Type 1 Driveway	Proposed Plan DGN	Optional
Type 2 Driveway Back of Entrance D&C Path = Design Standards/Roadway/Type 2 Driveway	Proposed Plan DGN	Optional
Type 3 Driveway Back of Entrance D&C Path = Design Standards/Roadway/Type 3 Driveway	Proposed Plan DGN	Optional
Type 4 Driveway Back of Entrance D&C Path = Design Standards/Roadway/Type 4 Driveway	Proposed Plan DGN	Optional
Type 5 Driveway Back of Entrance D&C Path = Design Standards/Roadway/Type 5 Driveway	Proposed Plan DGN	Optional
Side Road Tie Down Line D&C Path = Design Standards/Roadway/Force Side Road	Proposed Plan DGN	Optional
Sidewalk D&C Path = Design Standards/Roadside/Sidewalk (New)	Proposed Plan DGN	Optional
Retaining Wall D&C Path = Design Standards/Safety and Structures/New Retaining	Proposed Plan DGN	Optional

Side Slope and Drainage

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

ELEMENT	DGN DRAWING FILE	REQUIREMENT	Link
Fill Slope 1 Break Line D&C Path = Design Standards/Drainage/Slope Fill	GEOPAK Lines DGN	Optional	Fill Slope 1 Details
Cut Slope 1 Break Line D&C Path = Design Standards/Drainage/Slope Cut	GEOPAK Lines DGN	Optional	Ditch Fore Slope 1 Details
Berm Line D&C Path = Design Standards/Roadway/Berm Line	GEOPAK Lines DGN	Optional	Berm Details
Force Tie Slope D&C Path = Design Standards/Roadway/Force Tie Slope	GEOPAK Lines DGN	Optional	
Match Line D&C Path = Design Standards/Roadway/Matchline	GEOPAK Lines DGN	Optional	
Top of Levee Inside Edge D&C Path = Design Standards/Drainage/In Levee	GEOPAK Lines DGN	Optional	
Top of Levee Outside Edge D&C Path = Design Standards/Drainage/Out Levee	GEOPAK Lines DGN	Optional	

Paved Ditch

Used by the Proposed Paved Ditches typical section (PDitch).

ELEMENT	DGN DRAWING FILE	REQUIREMENT
Proposed Paved Ditch D&C Path = Design Standards/Drainage/Paved Ditch New	Proposed Plan DGN	**Required**
Proposed Slopes D&C Path = Design Standards/Cross Sections/Proposed Surfaces/Ground	Cross Section DGN	**Required**

Appendix 2 Define Variables

DGN File

These variables are used to define the name of the MicroStation file containing specific geometry used by the criteria files. **IMPORTANT**, if the file is not in the GEOPAK Project "Working Directory" then the complete drive letter and path **MUST** be specified. The plan element descriptions for each typical section state which elements need to be placed in which file. The following list gives all of the file variables and indicates which typical sections use a particular variable. Suggestions are also provided on what to include or exclude from a particular file.

Existing TOPO DGN

Used by Existing Features (ExFeat) and all reconstruction typical section (DRecon, NLtRRt, NRtRLt, & URECon).

Because many of the plan elements must cross the pattern line in pairs (edges of pavement, sidewalks, etc.) it is probably not a good idea to place all of the topographical information in this file. All that needs to be in this file are the items used to locate the existing features that are to be shown in the cross section.

Go to: Existing Pavement
Existing Paved Shoulder
Existing Curb and Gutter
Existing Paved Surfaces
Existing Sidewalks
Existing Paved Ditches
Existing Buildings
Existing Railroads
Existing Wall

Right of Way DGN

Used by the Draw Right of Way Lines (DrwROW) and all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

This drawing contains the existing and proposed right of way Lines.

Go to: Right of Way DGN Geometry Details

Cross Section DGN

Used by Proposed Paved Ditches (PDitch), Trace Existing Sub Layers (SubLay), and all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

This drawing contains the existing cross sections.

Proposed Plan DGN

Used by Proposed Paved Ditches (PDitch) and all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

This drawing contains the proposed design elements.

Go to: Appendix 5 Pavement
Appendix 7 Rural Shoulders
Appendix 8 Curbing With Urban Shoulders (U1 & U2)
Appendix 13 Rock Benches
Appendix 14 Sidewalk
Appendix 15 Retaining Walls
Grass Infield Gore

GEOPAK Lines DGN

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

This drawing contains the proposed GEOPAK design elements that are not normally shown on the plan sheets but are needed to control the criteria while processing the proposed cross sections. An example of an element shown in this file would be Fill Slope 1 Break Line. It is recommended to use the Pattern_Shape.DGN as the GEOPAK Lines DGN.

Go to: Berm Details
Fill Slope 1 Details
Match Lines
Levee and Optional Interception Ditch
Ditch Fore Slope 1 Details
Forced Closure using GEOPAK Lines DGN Element
Typical Section Before Match Line Details
Grass Infield Gore

Tapers File

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

This is the name of the tapers text file used to control tapering on the side slope as detailed later in this document. The variables will have default values. This is the original file copied to the working directory by the typical section generator. In the event the user chose to conduct tapering, it is recommended to rename this variable to a new file name and rename the actual file to match. This will prevent the user from over riding the text file when an additional typical section may be applied. **IMPORTANT**, if this file is not in the GEOPAK Project "Working Directory" then the complete drive letter and path **MUST** be specified.

Left Tapers File Name

This is the name of the tapers text file for the left side slope and is defaulted to TapersLt.txt.

Right Tapers File Name

This is the name of the tapers text file for the left side slope and is defaulted to TapersRt.txt.

Go to: Tapering Procedure Details
Tapering Example

Plot Scale

The plot scale variables are used to define the plot scale of various drawings that have items place in them by the criteria. The value is the plot scale in the formula: 1”=Plot Scale’. Consequently a plot scale of 10 is used for a 1”=10’ scale sheet, 50 is used for a 1”=50’ scale sheet, etc. The Define Variables section of each typical section gives information on the use of its plot scales. The following list contains all of the plot scale variables and indicates which typical sections use which variables.

XS Scale

Used by Draw Right of Way Lines (DrwROW), Existing Features (ExFeat), and all pavement typical sections DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

This is the scale of the cross section drawing. It is used in determining the text size for labeling slopes, elevations, and offsets on the proposed cross sections. For cross section plot scale of 1"=10' enter the number 10 as a value.

Go to: Existing Buildings
Existing Railroads
Existing Wall

Plan View Scale

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

This is the scale of the proposed plan drawing. It is used in determining the text size for labeling ditch slopes in the proposed plan view. For proposed plan plot scale of 1"=50' enter the number 50 as a value.

Go to: Draw Ditches In Plan View Details

Plan View Flow Arrow Scale

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

This will be the scale of the proposed plan drawing ditch flow arrows. It is used in determining the size of the ditch flow arrow cell in the proposed plan view. For proposed plan plot scale of 1"=50' enter the number 50 as a value.

Go to: Draw Ditches In Plan View Details

GPK Element

The GPK element variables are used to indicate the name of coordinate geometry objects that are used by the criteria. Typically they are used to draw to a particular location or elevation.

Survey Baseline Name

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

If a survey baseline is used that is different from the proposed baseline, the user may enter the name and the proposed cross sections will draw the baseline and label its offset. The default of "none" will cause this variable to be ignored. This alignment must be previously stored in COGO before processing cross sections.

Left Special Ditch Profiles and Right Special Ditch Profiles

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

These variables list the name(s) of the all of the optional **LEFT** & **RIGHT** special ditch profiles for a proposed cross section run. These profile(s) must be previously stored in COGO before processing cross sections. Commas must separate the profile names. Example: ltdit1,ltdit2,ltdit3 or rtdit1,rtdit2,rtdit3.

Go to: Special Ditch Profiles

Left Ditch Alignment and Right Ditch Alignment

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

These variables list the name of the optional **LEFT** & **RIGHT** ditch alignments. It allows the user to control the location of the toe of the ditch resides, which is where the chain intersects the cross section. This is helpful when trying to match with an existing culvert for example. It overrides the ditch fore slope 2 variable and forces the ditch to have a varying foreslope. Only ONE alignment per side is allowed per cross section run. This alignment must be previously stored in COGO before processing the cross sections. Example: ltditch1 or rtditch1.

Go to: Ditch Alignments

Left Match Line Profiles and Right Match Line Profiles

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

These variables list the name(s) of the optional **LEFT** & **RIGHT** match line profiles. A user may draw a match line in the GEOPAK lines file and the cross section will stop drawing at that location and label it as a match line. This variable expands on that concept and also allows the match line to be controlled vertically. For example, a user draws a match line through the fill slope 2 region. The fill slope 2 variable is set to a run:rise value of 3:-1. Without a match line profile, the fill slope 2 line would be drawn at a 3:-1 until intersecting the match line. This variable will force an "over ride" of the fill slope 2 variable and force the final fill slope 2 line to be drawn to the named match line profile. Commas must separate the profile names. Example: ml1lt,ml2lt,ml3lt or ml1rt,ml2rt,ml3rt.

Go to: Typical Section Before Match Line Details
Match Line Chain and Profile Details

Left Sidewalk Profiles and Right Sidewalk Profiles

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

These variables list the name(s) of the all of the optional **LEFT** & **RIGHT** sidewalk profiles for a proposed cross section run. The profile will be applied to the inside edge of the proposed sidewalk only when it is not adjacent to the back of curb. The profile(s) must be previously stored in COGO. The profile names are to be separated by commas. Example: ltsw1,ltsw2,ltsw3 or rtsw1,rtsw2,rtsw3

Go to: Sidewalk Elevation

Left Interception Special Ditch Profiles and Right Interception Special Ditch Profiles

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

These variables list the name(s) of the all of the optional **LEFT** & **RIGHT** interception special ditch profiles located on the outside of the proposed levee. These profile(s) must be previously stored in COGO before processing cross sections. Commas must separate the profile names. Example: ltlev1,ltlev2,ltlev3 or rtlev1,rtlev2,rtlev3.

Go to: Levee and Optional Interception Ditch

Median Ditch Profiles

Used by divided pavement typical sections (DNPavt, DRecon, NLtRRt, & NRtRLt).

This variable lists the name(s) of the all of the optional median ditch profiles for a proposed cross section run. This profile will be applied to the median types 1 and 3 only, which are described within the redefinable variable _s_MedianType. These profile(s) must be previously stored in COGO before processing cross sections. The profile names are to be separated by commas. Example: MD1,MD2,MD3

Ramp Chain Names

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

This variable lists the name(s) of the all of the optional proposed ramp chain names. It is used for resolving paved gores. The ramp chain name spelling must exactly match the ramp profile name. For example, a user has a ramp chain named "ramp1". Then the profile name must also be "ramp1". The criteria will check to see if the pavement should continue from the edge of the mainline pavement to the ramp chain and profile. Commas must separate the profile names. Example: ramp1,ramp2,ramp3. **IMPORTANT:** The listing of the ramp chains MUST NOT include any blank spaces.

Go to: Ramp Transition Chain and Profile Design Procedure

Match Line Chain Names

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

This variable lists the name(s) of the all of the optional proposed match line chain names. It is used for resolving grass gores. The match line chain name spelling must exactly match the match line profile name. For example, a user has a match line chain named "ML1". Then the profile name must also be "ML1". The criteria checks to see if the grass slopes are to draw to a match line chain and profile. Commas must separate the profile names. Example: ML1,ML2,ML3. **IMPORTANT:** The listing of the match line chains MUST NOT include any blank spaces.

Go to: Match Line Chain and Profile Details
Match Line Cross-Section Details for Non-Controlling Roadway

Left Top of Wall Profiles and Right Top of Wall Profiles

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

These variables list the name(s) of the all of the optional **LEFT** & **RIGHT** profiles to control the elevation of the top of retaining wall for a proposed cross section run. These profile(s) must be previously stored in COGO before processing cross sections. The profile names are to be separated by commas. Example: LTW1,LTW2,LTW3 or RTW1,RTW2,RTW3.

Go to: Height Set by Elevation of the Top of the Wall

Left Top of Footing Profiles and Right Top of Footing Profiles

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

These variables list the name(s) of the all of the optional **LEFT** & **RIGHT** profiles to control the elevation of the top of the footing of retaining wall for a proposed cross section run. These profile(s) must be previously stored in COGO before processing cross sections. The profile names are to be separated by commas. Example: LTF1,LTF2,LTF3 or RTF1,RTF2,RTF3.

Go to: Footing Cross-Section Details

Median Top of Footing Profiles

Used by divided pavement typical sections only (DNPavt, DRecon, NLtRRt, & NRtRLt).

This variable lists the name(s) of the all of the optional **MEDIAN TOP OF FOOTING** retaining wall profiles for a proposed cross section run. This profile will be applied to the top of the proposed median retaining wall footing. These profile(s) must be previously stored in COGO before processing cross sections. The profile names are to be separated by commas. Example: MTF1,MTF2,MTF3

Go to: Footing Cross-Section Details

Appendix 3 Redefinable Variables

This appendix lists the available redefinable variables with an example. They are grouped by type, reflecting what they do.

Show Existing Features Redefinable Variables

Used by Existing Features Typical Section (ExFeat). The show redefinable variables control whether or not a specific feature is drawn in the cross section. Specify ^Yes^ or ^No^ for each feature listed. The carets "^" are required. A generic example is shown to the right.

```
EXAMPLE:    if (Sta >= 0+00 R 1)
                {
                    _s_VariableName = ^Yes^
                }
```

_s_ShowShoulders

Controls whether or not existing shoulders are drawn. Go To: Existing Paved Shoulder

_s_ShowSidewalk

Controls whether or not existing sidewalks ditches are drawn. Go To: Existing Sidewalks

_s_ShowPavedDitch

Controls whether or not existing paved ditches are drawn. Go To: Existing Paved Ditches

_s_ShowPavedSurface

Controls whether or not existing paved surfaces are drawn. Go To: Existing Paved Surfaces

_s_ShowBuildings

Controls whether or not the edges of existing building are marked. Go To: Existing Buildings

_s_ShowRailroadTracks

Controls whether or not the location of existing railroad tracks are marked. Go To: Existing Railroads

_s_ShowRetainingWall

Controls whether or not the location of existing retaining walls are marked. Go To: Existing Wall

_s_ShowCurbandGutter

Controls whether or not existing curb and gutter are drawn. Go To: Existing Curb and Gutter

Draw Top of Rock Line Redefinable Variable

_s_DrawRockLine

Used by Trace Existing Sub Layers Typical Section (SubLay).

Controls whether to draw the top of rock line when no top of rock is found on the current cross section. This has been implemented to allow the user to run earthwork when rock is present on some, but not all, of the cross sections. If rock is to be considered, a top of rock line must reside on ALL cross sections. If the variable is set to ^Yes^ and a rock line is NOT found on a section, a top of rock line will be drawn 100 feet below the existing ground. This will then allow earthwork to process normally. The options are ^Yes^ or ^No^. The carets "^" are required.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _s_DrawRockLine = ^Yes^
    }
```

Special Ditch Label Redefinable Variable

_s_SpecialDitchLabel

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

The special ditch text string redefinable variable controls the content of labels placed on all ditches that use a special ditch profile. Values are place between carets "^", which are required.

EXAMPLE:

Go to: Special Ditch Options

```
if (Sta >= 0+00 R 1)
    {
        _s_SpecialDitchLabel = ^S.D.^
    }
```

Label Control Redefinable Variables

The label control redefinable variables determine whether or not a specific label feature will be shown. Specify ^Yes^ or ^No^ for each feature listed. The carets "^" are required.

_s_LabelShoulderElevations

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

Controls whether to label edge of proposed shoulder elevations and offsets in the cross section view.

EXAMPLE: Go to: Shoulders In Cross Section

```
if (Sta >= 0+00 R 1)
    {
        _s_LabelShoulderElevations = ^Yes^
    }
```

_s_DrawDitchesInPlanView

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

Controls whether to draw ditches in the Proposed Plan DGN while processing the proposed cross sections. If set to ^Yes^, the edges of the ditch, the average ditch slope between cross sections, and flow arrows are drawn.

EXAMPLE: Go to: Draw Ditches In Plan View Details
Grass Infield Gore

```
if (Sta >= 0+00 R 1)
    {
        _s_DrawDitchesInPlanView = ^No^
    }
```

Draw Underdrain Redefinable Variables

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

The draw underdrain redefinable variables control whether or not to include edge underdrains. These options are given to conform to MoDOT practice as specified in the Project Development Manual (PDM) section 6-02.3:

> Pavement edge drains are required for new rigid or flexible pavements on medium and heavy duty routes, and permeable base courses will be provided on all heavy duty pavements with the following exceptions. Pavement edge drains and permeable base courses are not required where a minimum of 2 ft. [0.6 m] of day lighted rock base can be furnished for the top of the subgrade or where hydraulically placed sand fill comprises the top 4 ft. [1.2 m] of the embankment with not more than 2 ft. [0.6 m] of soil cap on the slopes. Thin courses of permeable bases cannot be relied upon to provide permanent drainage when day lighted and should never be used without longitudinal edge drains (Rev. 7-1-98).

Separate variables are given for the left and right side. The variable value can be either ^Yes^ or ^No^ to draw the proposed pavement underdrain. When set to ^Yes^ the underdrain will be drawn for that side except for the following two conditions. An underdrain will NOT be drawn if the pavement slope is greater than zero because the pavement cross slope does not flow towards the shoulder. Secondly, an underdrain will not be drawn if the rock fill base is present and set to daylight. The carets "^" are required.

The examples below give the default values for the variables.

_s_DrawLeftUnderdrain

Controls the left side.

EXAMPLE: Go to: Under Drain Details

```
if (Sta >= 0+00 R 1)
    {
        _s_DrawLeftUnderdrain = ^No^
    }
```

_s_DrawRightUnderdrain

Controls the left side.

For an example see _s_DrawLeftUnderdrain. The only difference is the name of the variable. Go to: Under Drain Details

Type Redefinable Variables

The type redefinable variables are used to select between different options within the criteria. All require a caret (^) before and after the type, since these are string variables and GEOPAK uses carets to designate that a value is a text string rather than a numeric value.

_s_PavementType

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

Controls proposed pavement type. Use ^C^ or ^B^ for concrete or bituminous pavement respectively. This will determine if the edge of pavement is closed vertically for concrete or 1:1 for bituminous.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _s_PavementType = ^B^
    }
```

Go to: Pavement Details

_s_OutsideShoulderType

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

Determines the material type for the "outside" or non-median shoulder. The options are as follows:
^C^ = Concrete
^B^ = Bituminous
^A^ = Aggregate
^E^ = Earth

EXAMPLE:

Go to: Determining Shoulder Width and Type

```
if (Sta >= 0+00 R 1)
    {
        _s_OutsideShoulderType = ^B^
    }
```

Type Redefinable Variables (continued)

_s_MedianType

Used by divided pavement typical sections (DNPavt, DRecon, NLtRRt, & NRtRLt).

Determines proposed median type. Types 1-4 are all rural grass medians with no thickness shown. Type 5 has a raised median, which is paved if the width of the median does not exceed the redefinable variable _d_MaxPavedMedianWidth. Type 6 is flush paved median with a Type A or C concrete barrier, which may be flat on the bottom or stepped. It requires one and only one new edge of shoulder line is to be drawn between the median edges of pavement. This single shoulder line represents the centerline location of the concrete barrier. The Type 7 median has a retaining wall in the median. It requires two new edge of shoulder lines to be drawn between the median edges of pavement. The distance between the edges of shoulders controls the width of the retaining wall less a "hard coded" buffer distance of 1 inch on each side of the wall.

The options are as follows:

^1^ = Fixed slope and fixed depth with a variable ditch bottom width.
^2^ = Fixed slope and fixed ditch width with a variable ditch depth.
^3^ = Fixed ditch depth and fixed ditch bottom width with variable slopes.
^4^ = "V" Ditch with fixed slopes and a variable depth.
^5^ = Crowned median between curbs with the sloped controlled by the positive value of _d_MedianSlope1. The optional variable _d_PavedMedianThickness may be set greater than zero to show a thickness for this median type assuming the width of the median does not exceed the variable named _d_MaxPavedMedianWidth.
^6A^ or ^6C^ = Stepped Median Barrier using type A or type C barrier respectively
^7^ or ^7B^ = Retaining Wall median without barrier on top "7" or with Barrier on top "7B"

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _s_MedianType = ^3^
    }
```

Go to: Median Ditch Profiles

Type Redefinable Variables (continued)

_s_MedianShoulderType

Used by all divided pavement typical sections (DNPavt, DRecon, NLtRRt, & NRtRLt).

Determines the material type for the "median" shoulder. The options are as follows:
^C^ = Concrete
^B^ = Bituminous
^A^ = Aggregate
^E^ = Earth

EXAMPLE: Go to: Determining Shoulder Width and Type

```
if (Sta >= 0+00 R 1)
    {
        _s_MedianShoulderType = ^B^
    }
```

_s_OverlayType

Used by pavement reconstruction typical sections (DRecon, NLtRRt, NRtRLt, & URECon).

Determines if the proposed overlay is for crown correction or is to match the existing pavement. The options are ^CC^ for Crown Correction, which uses proposed pavement shapes to correct the cross slope, and ^ME^ for Match Existing, which traces the existing ground line. The carets "^" are required.

EXAMPLE: Go to: Appendix 6 Reconstruction

```
if (Sta >= 0+00 R 1)
    {
        _s_OverlayType = ^ME^
    }
```

Note: If you are not doing crown correction it is recommended that the default pavement symbology in the Proposed Cross Sections run be modified so it is drawn on an otherwise unused level so that these lines can be deleted easily. To do this go to the Plot Parameters section of the dialog and modify the XS Lines placement level to one not being used.

Slope Control Redefinable Variables

The slope control redefinable variables are used to select between different options within the criteria. All require a caret (^) before after the variable value since these are string variables and carets designate that a value is a text string rather than a numeric value.

_s_ExtensionSlope

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

Determines whether aggregate base extension slope matches pavement slope or shoulder slope. Options are:
^P^ = pavement slope
^S^ = shoulder slope
This only has an effect on light duty pavements on an aggregate base with ADT < 3500, as specified in PDM Figures 6-03.1 & 6-03.2, effective 10-10-03.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _s_ExtensionSlope = ^S^
    }
```

Go to: Aggregate Base Details
Type B Shoulders (8” Aggregate Shoulders)
Type C Shoulders (6” Aggregate Shoulders)
Type D Shoulders (3” Minimum Aggregate Shoulders)
Type E Shoulders (Earth Shoulders)

_s_GutterSlopeInSuper

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

Controls high side super gutter pan slope. Options are:
^U^ for up
^D^ for down
Effects type A and B curb and gutter only. If ^D^ or "down" is selected then the gutter will hold water on the high side of super elevation. If ^U^ or "up" is selected then the gutter pan will not hold water in the high side of super elevation.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _s_GutterSlopeInSuper = ^U^
    }
```

Go to: Curb & Gutter Details

Slope Control Redefinable Variables (continued)

_s_OverlayOffsetLocation

Used by pavement reconstruction typical sections (DRecon, NLtRRt, NRtRLt, & URECon).

Denotes the elevation control point for the top of the overlay. It functions like the Profile Grade Line or Tie location used for new pavement drawn using shapes. Options are:
^L^ = Left edge of existing pavement
^R^ = Right edge of existing pavement
^C^ = Center of existing pavement
^P^ = Use proposed profile

Go to: Appendix 6 Reconstruction

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _s_OverlayOffsetLocation = ^P^
    }
```

_s_WideningSlope

Used by pavement reconstruction typical sections (DRecon, NLtRRt, NRtRLt, & URECon).

Determines the slope for proposed pavement widening. ^ME^ = "Match Existing" and a number encompassed within carets represents a slope in percent format i.e. ^-2^ for a -2% slope.

EXAMPLE:

Go to: Appendix 6 Reconstruction

```
if (Sta >= 0+00 R 1)
    {
        _s_WideningSlope = ^ME^
    }
```

Rock Fill Base Daylighting Redefinable Variables

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

The rock fill base daylighting redefinable variables control the extension of the rock fill base from under the pavement. These options are given to conform to MoDOT practice as specified in the Project Development Manual (PDM) section 6-03.7:

> Rock base consists of 18 in. [0.45 m] of Class C excavation. It is placed full roadbed width and daylighted to the in-slope or fillslope, except on the high side of superelevated curves and when not economically feasible under light duty pavements, in which case the rock base is not daylighted to the ditch and soil is used as a fill material at these locations (Rev. 10-10-03).

The variable value can be either ^Yes^ or ^No^ to "daylight" the rock fill base. The carets "^" are required.

The examples below give the default values for the variables.

_s_RockFillBaseDaylight

Controls whether or not to "daylight" the rock fill base. If the criteria determines that it is not possible to daylight the rock fill base then it will close off the rock fill base at a 1:1 slope beyond the shoulder or curb and gutter.

EXAMPLE: Go to: Rock Base Details

```
if (Sta >= 0+00 R 1)
    {
        _s_RockFillBaseDaylight = ^Yes^
    }
```

_s_RockFillBaseDaylightHSS

Controls whether or not to "daylight" the rock fill base in the high side of super elevation (HSS). This will be an "override" of the variable _s_RockFillBaseDaylight for high side super elevation only.

EXAMPLE: Go to: Rock Base Details

```
if (Sta >= 0+00 R 1)
    {
        _s_RockFillBaseDaylightHSS = ^No^
    }
```

Existing Features Dimension Redefinable Variables

Used by Existing Features Typical Section (ExFeat).

This set of variables controls the dimensions of existing features drawn in the cross sections. All values are in master units. The number **MUST** be greater than zero.

_d_ExistingFeatureLineHeight

Defines the height of the line representing the location of the existing features.

EXAMPLE: Go to: Existing Buildings; Existing Railroads; Existing Wall

```
if (Sta >= 0+00 R 1)
    {
        _d_ExistingFeatureLineHeight = 10
    }
```

_d_ExistPavtThick

This is the thickness of the existing pavement structure.

EXAMPLE: Go to: Existing Pavement

```
if (Sta >= 0+00 R 1)
    {
        _d_ExistPavtThick = 1
    }
```

_d_ExistShouldThick

This is the thickness of the existing shoulder from the top of shoulder to the bottom.

EXAMPLE: Go to: Existing Paved Shoulder

```
if (Sta >= 0+00 R 1)
    {
        _ _d_ExistShouldThick = 6/12
    }
```

Existing Features Dimension Redefinable Variables (continued)

Used by Existing Features Typical Section (ExFeat).

_d_ExistSidewalkThick

This is the total thickness of the existing sidewalk structure from the top of sidewalk to the bottom. See MoDOT Standard Plan 608.10.

EXAMPLE: Go to: Existing Sidewalks

```
if (Sta >= 0+00 R 1)
    {
        _d_ExistSidewalkThick = 4/12
    }
```

_d_ExistPavedDitchThick

This is the total thickness of existing paved ditches from the top of existing ground to the bottom of the paved ditch. See MoDOT Standard Plan 609.15.

EXAMPLE: Go to: Existing Paved Ditches

```
if (Sta >= 0+00 R 1)
    {
        _d_ExistPavedDitchThick = 6/12
    }
```

_d_ExistPavedSurfaceThick

This is the total thickness of existing paved surfaces from the top of existing ground to the bottom of the paved surface(s).

EXAMPLE: Go to: Existing Paved Surfaces

```
if (Sta >= 0+00 R 1)
    {
        _d_ExistPavedSurfaceThick = 4/12
    }
```

Existing Features Dimension Redefinable Variables (continued)

Used by Existing Features Typical Section (ExFeat).

_d_ExistCurbGutterThick

This is the total thickness of existing curb and gutter from the top of existing surface to the bottom of the curb and gutter at the edge of existing pavement. See MoDOT Standard Plan 609.00.

EXAMPLE: Go to: Existing Curb and Gutter

```
if (Sta >= 0+00 R 1)
    {
        _d_ExistCurbGutterThick = 7/12
    }
```

_d_ExistCurbGutterWidth

This is the total width of the existing curb and gutter from the edge of existing pavement to the back of curb. See MoDOT Standard Plan 609.00.

EXAMPLE: Go to: Existing Curb and Gutter

```
if (Sta >= 0+00 R 1)
    {
        _d_ExistCurbGutterWidth = 9/12
    }
```

Right of Way Line Redefinable Variable

_d_RightofWayLineHeight

Used by the Draw Right of Way Lines Typical Section (DrwROW).

This is the height of the line in master units drawn to represent the location of existing and proposed right of way. The number **MUST** be greater than zero.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_RightofWayLineHeight = 10
    }
```

Search Distance Redefinable Variables

The search distance redefinable variables determine how far to search in the plan view for certain items. If the item is located within the search distance, it will be included in the cross section criteria process. If the item is beyond the search distance it will not be used by the criteria. Unless noted otherwise, the variables are required to avoid locating a plan view element from an adjacent or parallel roadway that might happen to cross the pattern line for the proposed cross section being drawn. All values are in master units. The number **MUST** be greater than zero.

_d_OutsideShoulderSearchDistance

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

Used to locate an "outside" non-median shoulder line. The distance is measured from the proposed edge of pavement.

EXAMPLE: Go to: Determining Shoulder Width and Type

```
if (Sta >= 0+00 R 1)
    {
        _d_OutsideShoulderSearchDistance = 18
    }
```

_d_MedianShoulderSearchDistance

Used by divided pavement typical sections (DNPavt, DRecon, NLtRRt, & NRtRLt).

Used to locate an "outside" non-median shoulder line. The distance is measured from the proposed edge of pavement.

EXAMPLE: Go to: Determining Shoulder Width and Type

```
if (Sta >= 0+00 R 1)
    {
        _d_OutsideShoulderSearchDistance = 18
    }
```

Search Distance Redefinable Variables (continued)

_d_CurbSearchDistance

Used by existing features (ExFeat) and all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

Used to locate a curb and or curb & gutter or gutter line. The distance is measured from the edge of pavement or shoulder depending on location. For existing curb, it is always measure from the edge of existing pavement.

EXAMPLE:
```
if (Sta >= 0+00 R 1)
    {
        _d_CurbSearchDistance = 3
    }
```

Go to: Existing Curb and Gutter
Curbing Plan View Geometry
U2 Shoulder Details

_d_U2ShoulderSearchDistance

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

Allowable search distance in feet to locate an "outside" edge line of the U2 shoulder located behind the proposed curb and or curb and gutter. This distance is measured from the proposed back of curb.

EXAMPLE:
```
if (Sta >= 0+00 R 1)
    {
        _d_U2ShoulderSearchDistance = 10
    }
```

Go to: U2 Shoulder Details

_d_RampChainSearchDistance

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

Defines the proposed ramp(s) search distance to locate the ramp chain(s) used for resolving paved gores. This distance is measured from the edge of the "mainline" pavement.

EXAMPLE:
```
if (Sta >= 0+00 R 1)
    {
        _d_RampChainSearchDistance = 25
    }
```

Go to: Ramp Transition Chain and Profile Design Procedure

Search Distance Redefinable Variables (continued)

_d_MatchLineChainSearchDistance

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

Distance measured from the edge of shoulder, curb, or berm to look for a match line chain. Primarily used for grass gore resolution.

EXAMPLE:

Go to: Match Line Chain and Profile Details
Match Line Cross-Section Details for Non-Controlling Roadway

```
if (Sta >= 0+00 R 1)
    {
        _d_MatchLineChainSearchDistance = 100
    }
```

_d_AdjacentWallSearchDistance

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

The purpose of this variable is **NOT** to avoid locating a plan view element from an adjacent or parallel roadway that might happen to cross the pattern line for the proposed cross section being drawn. **Rather**, it is used to determine if the retaining wall is adjacent to the shoulder or located in the grass side slope. If the wall is closer to the edge of shoulder than this distance the aggregate base(s) will draw directly to the face of the wall.

EXAMPLE:

Go to: Appendix 15 Retaining Walls

```
if (Sta >= 0+00 R 1)
    {
        _d_AdjacentWallSearchDistance = 12/12
    }
```

Default Width Redefinable Variables

The default width redefinable variables are used only when no plan elements are found to determine the width of a cross section item. The value is in master units and can be zero or greater than zero. If the value is zero and the corresponding plan element is not found, the item will not be drawn. A plan element will **ALWAYS** "override" these variables.

_d_OutsideShoulderWidth

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). Proposed shoulder width of the "outside" or non-median shoulder when no plan element is found designating the width.

EXAMPLE:
```
if (Sta >= 0+00 R 1)
    {
        _d_OutsideShoulderWidth = 8
    }
```
Go to: Determining Shoulder Width and Type

_d_U2ShoulderWidth

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). U2 shoulder width when no plan element is found designating the width. This is measured from the back of curb.

EXAMPLE:
```
if (Sta >= 0+00 R 1)
    {
        _d_U2ShoulderWidth = 0
    }
```
Go to: U2 Shoulder Details

_d_MedianShoulderWidth

Used by divided pavement typical sections (DNPavt, DRecon, NLtRRt, & NRtRLt). Median shoulder width when no plan element is found in the designated width.

EXAMPLE:
```
if (Sta >= 0+00 R 1)
    {
        _d_MedianShoulderWidth = 4
    }
```
Go to: Determining Shoulder Width and Type

Default Width Redefinable Variables (continued)

_d_MedianSlope1Width

Used by divided pavement typical sections (DNPavt, DRecon, NLtRRt, & NRtRLt). Optional median slope 1 width. This is equivalent to the berm width, except it is on the median side.

EXAMPLE:
```
if (Sta >= 0+00 R 1)
    {
        _d_MedianSlope1Width = 0
    }
```
Go to: Appendix 11 Medians

_d_BermWidth_Left

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). LEFT berm slope width when no plan element is found designating the width. This is measured from the back of curb or edge of shoulder. **IMPORTANT:** In the event a sidewalk is required, the berm width must be set such that the back edge of the berm must be beyond the back of the sidewalk or the sidewalk will not be drawn.

EXAMPLE:
```
if (Sta >= 0+00 R 1)
    {
        _d_BermWidth_Left = 0
    }
```
Go to: Berm Details

_d_BermWidth_Right

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). RIGHT berm slope width when no plan element is found designating the width. This is measured from the back of curb or edge of shoulder. **IMPORTANT:** In the event a sidewalk is required, the berm width must be set such that the back edge of the berm must be beyond the back of the sidewalk or the sidewalk will not be drawn.

EXAMPLE:
```
if (Sta >= 0+00 R 1)
    {
        _d_BermWidth_Left = 0
    }
```
Go to: Berm Details

Default Width Redefinable Variables (continued)

_d_DitchForeSlope1Width_Left

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). LEFT ditch slope 1 width when no plan element is found. This is measured from the back of curb, edge of shoulder, or edge of berm.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_DitchForeSlope1Width_Left = 0
    }
```

Go to: Ditch Fore Slope 1 Details

_d_DitchForeSlope1Width_Right

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). RIGHT ditch slope 1 width when no plan element is found. This is measured from the back of curb, edge of shoulder, or edge of berm.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_DitchForeSlope1Width_Right = 0
    }
```

Go to: Ditch Fore Slope 1 Details

_d_FillSlope1Width_Left

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). LEFT optional fill slope 1 width when no plan element is found, as measured from the back of curb, edge of shoulder, or edge of berm.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_FillSlope1Width_Left = 24
    }
```

Go to: Fill Slope 1 Details

_d_FillSlope1Width_Right

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). RIGHT optional fill slope 1 width when no plan element is found, as measured from the back of curb, edge of shoulder or edge of berm.

For an example see _d_FillSlope1Width_Left. The only difference is the name of the variable.

Go to: Fill Slope 1 Details

Percent Slope Redefinable Variables

The percent slope redefinable variables are used to define the slope of a surface in percent format. Enter the value without the percent sign (-2% slope is entered as –2). Include the negative sign when applicable.

_d_NormalPavementSlope

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). It represents the normal pavement crown slope and controls proposed pavement slope. This is typically –2% or similar. It directly affects the way super elevation transitions are handled.

Go to: Pavement Details

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_NormalPavementSlope = -2
    }
```

_d_U2ShoulderSlope

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). Defines proposed U2 shoulder slope in percent. This is typically a 2% or similar.

Go to: U2 Shoulder Details

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_U2ShoulerSlope = 2
    }
```

_d_NormalOutsideShoulderSlope

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). Controls proposed "outside" non-median shoulder slope. This is typically –4% or similar. It represents normal shoulder slope when no super elevation is present.

Go to: Shoulders In Cross Section page 125, 126, 127, or 128

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_NormalOutsideShoulderSlope = -4
    }
```

_d_NormalMedianShoulderSlope

Used by divided pavement typical sections (DNPavt, DRecon, NLtRRt, & NRtRLt). Proposed median shoulder slope. This is typically a -2% or similar. It represents normal shoulder slope when no super elevation is present.

Go to: Shoulders In Cross Section

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_NormalMedianShoulderSlope = -2
    }
```

Percent Slope Redefinable Variables (continued)

_d_BermSlope_Left

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). Proposed LEFT berm slope, which is the earth slope adjacent to the shoulder or curb.

EXAMPLE: Go to: Berm Details

```
if (Sta >= 0+00 R 1)
    {
        _d_BermSlope_Left = 2
    }
```

_d_MedianSlope1

Used by divided pavement typical sections (DNPavt, DRecon, NLtRRt, & NRtRLt). It is for an optional median slope 1, which is the slope beyond the shoulder or curb within the median.

EXAMPLE: Go to: _s_MedianType Appendix 11 Medians

```
if (Sta >= 0+00 R 1)
    {
        _d_MedianSlope1 = -2
    }
```

_d_Max_Type1_Driveway_Slope

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). Proposed maximum allowable Type 1 driveway slope. If the driveway slope exceeds this value a message is drawn to alert the user.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_Max_Type1_Driveway_Slope = 10
    }
```

_d_BermSlope_Right

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). Proposed RIGHT berm slope, which is the earth slope adjacent to the shoulder or curb.

EXAMPLE: Go to: Berm Details

```
if (Sta >= 0+00 R 1)
    {
        _d_BermSlope_Right = 2
    }
```

_d_SidewalkSlope

Used by all pavement typ. sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). Proposed sidewalk slope.

EXAMPLE: Go to: Sidewalk Elevation

```
if (Sta >= 0+00 R 1)
    {
        _d_SidewalkSlope = 2
    }
```

_d_Max_Type1_Roll_Over_Slope

Used by all pavement typ. sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). Proposed maximum allowable Type 1 driveway rollover slope. If the difference in slope between the entrance pad and the tie down to ground exceeds this value, a vertical curve entrance is drawn with the length of the vertical curve controlled by _d_EntranceVertCurveLength.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_Max_Type1_Roll_Over_Slope = 10
    }
```

Percent Slope Redefinable Variables (continued)

_d_Max_Type2_Driveway_Slope

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). Proposed maximum allowable Type 2 driveway slope. If the driveway slope exceeds this value a warning message is drawn.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_Max_Type2_Driveway_Slope = 5
    }
```

_d_Max_Type3_Driveway_Slope

Proposed maximum allowable Type 3 driveway slope. If the driveway slope exceeds this value a warning message is drawn.

For an example see _d_Max_Type2_Driveway_Slope. The only difference is the name of the variable.

_d_Max_Type4_Driveway_Slope

Proposed maximum allowable Type 4 driveway slope. If the driveway slope exceeds this value a warning message is drawn.

For an example see _d_Max_Type2_Driveway_Slope. The only difference is the name of the variable.

_d_Max_Type5_Driveway_Slope

Proposed maximum allowable Type 5 driveway slope. If the driveway slope exceeds this value a warning message is drawn.

For an example see _d_Max_Type2_Driveway_Slope. The only difference is the name of the variable.

_d_Max_Type2_Roll_Over_Slope

Used by all pavement typ. sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). Proposed maximum allowable Type 2 driveway rollover slope. If the difference in slope between the entrance pad and the tie down to ground exceeds this value, a vertical curve entrance is drawn with the length of the vertical curve controlled by _d_EntranceVertCurveLength.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_Max_Type2_Roll_Over_Slope = 10
    }
```

_d_Max_Type3_Roll_Over_Slope

Proposed maximum allowable Type 3 driveway rollover slope. It functions _d_Max_Type2_Roll_Over_Slope.

For an example see _d_Max_Type2_Roll_Over_Slope. The only difference is the name of the variable.

_d_Max_Type4_Roll_Over_Slope

Proposed maximum Type 4 driveway rollover slope in percent. It functions _d_Max_Type2_Roll_Over_Slope.

For an example see _d_Max_Type2_Roll_Over_Slope. The only difference is the name of the variable.

_d_Max_Type5_Roll_Over_Slope

Proposed maximum Type 5 driveway rollover slope. It functions _d_Max_Type2_Roll_Over_Slope.

For an example see _d_Max_Type2_Roll_Over_Slope. The only difference is the name of the variable.

Pavement Thickness Redefinable Variables

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

The pavement thickness redefinable variables determine how the pavement is drawn. It is the distance from the top of the layer to the bottom of the layer. All values are in master units. The number for the first layer **MUST** be greater than zero. The number for all other layers may be greater than zero or zero but never less than zero. If it is set to zero that layer will not be drawn.

_d_PavementLayer1Thick

This is the thickness of the first of four possible pavement structure thicknesses.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_PavementLayer1Thick = 1.75/12
    }
```

Go to: Concrete Pavement Details
Bituminous Pavement Details
Integral Curb Types A, M, O, and E

_d_PavementLayer2Thick

This is the thickness of the second of four possible pavement structure thicknesses.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_PavementLayer2Thick = 0/12
    }
```

Go to: Bituminous Pavement Details

_d_PavementLayer3Thick

This is the thickness of the third of four possible pavement structure thicknesses.

For an example see _d_PavementLayer2Thick = 0/12. The only difference is the name of the variable.

_d_PavementLayer4Thick

This is the thickness of the fourth of four possible pavement structure thicknesses.

For an example see _d_PavementLayer2Thick = 0/12. The only difference is the name of the variable.

Overlay Thickness Redefinable Variables

Used by pavement reconstruction typical sections (DRecon, NLtRRt, NRtRLt, & URECon).

The overlay thickness redefinable variables determine how the reconstruction pavement overlay is drawn. It is the distance from the top of the layer to the bottom of the layer. All values are in master units. The number for all other layers may be greater than zero or zero but never less than zero. If it is set to zero that layer will not be drawn.

_d_OverlayThickness1

This is the thickness of the first of two possible overlay pavement layers. It **MUST** be greater than zero. If the reconstruction consists of a widening only set this value to two times the tolerance, which has a default value of 0.01. Thus if the default tolerance value is used set the variable to 0.02 if there is widening without an overlay.

EXAMPLE: Go to: Appendix 6 Reconstruction

```
if (Sta >= 0+00 R 1)
    {
        _d_OverlayThickness1 = 0/12
    }
```

_d_OverlayThickness2

This is the thickness of the second of two possible overlay pavement layers. It may be greater than zero or zero but never less than zero. If it is set to zero the layer will not be drawn.

EXAMPLE: Go to: Appendix 6 Reconstruction

```
if (Sta >= 0+00 R 1)
    {
        _d_OverlayThickness2 = 0/12
    }
```

Shoulder Thickness Redefinable Variables

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

The shoulder thickness redefinable variables determine how the shoulder is drawn. It is the distance from the top of the layer to the bottom of the layer. All values are in master units. The number for the first layer **MUST** be greater than zero. The number for all other layers may be greater than zero or zero but never less than zero. If it is set to zero that layer will not be drawn. **Note**: If the thicknesses of the shoulder and the corresponding pavement layers match then no break will be drawn between the edge of pavement and the edge of shoulder. In essence, it will be one continuous layer of pavement spanning both the pavement and shoulder until a layer is reached for which the shoulder and pavement have different thicknesses.

_d_ShoulderLayer1Thick

This is the thickness of the first of four possible shoulder structure thicknesses.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_ShoulderLayer1Thick = 6/12
    }
```

Go to: Shoulders In Cross Section; page 125, 126, 127, or 128
Integral Curb Types A, M, O, and E Details
Integral Curb Types B and N Details

_d_ShoulderLayer2Thick

This is the thickness of the second of four possible shoulder structure thicknesses.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_ShoulderLayer2Thick = 0/12
    }
```

_d_ShoulderLayer3Thick

This is the thickness of the third of four possible shoulder structure thicknesses.

_d_ShoulderLayer4Thick

This is the thickness of the fourth of four possible shoulder structure thicknesses.

U2 Shoulder Thickness Redefinable Variables

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

The U2 shoulder thickness redefinable variables determine how the U2 shoulder is drawn. It is the distance from the top to the bottom of the layer. All values are in master units. The number **MUST** be greater than zero or equal to zero. If it is set to zero the layer will not be drawn. See PDM Figure 6-04.1 for suggested values.

_d_U2ShoulderThickness

This is the proposed U2 shoulder thickness.

EXAMPLE: Go to: U2 Shoulder Details

```
if (Sta >= 0+00 R 1)
    {
        _d_U2ShoulderThickness = 2/12
    }
```

_d_U2ShoulderAggbaseThickness

This is the proposed U2 shoulder aggregate base thickness.

EXAMPLE: Go to: U2 Shoulder Details

```
if (Sta >= 0+00 R 1)
    {
        _d_U2ShoulderAggbaseThickness = 4/12
    }
```

Base Layer Thickness Redefinable Variables

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

The base layer thickness redefinable variables determine how the pavement base is drawn. All values are in master units, which can be zero or greater than zero, except as noted below. If it is set to zero the layer will not be drawn.

_d_Aggbase1Thickness

Proposed aggregate pavement base 1 thickness. This number **MUST** be greater than zero **if** a thickness is specified for optional Aggbase 2 thickness. If an Aggbase 2 is thickness is greater than zero, this layer will be drawn as a Stabilized Permeable Base.

EXAMPLE: Go to: Aggregate Base Details; Rock Base Details

```
if (Sta >= 0+00 R 1)
    {;
        _d_Aggbase1Thickness = 4/12
    }
```

_d_Aggbase2Thickness

Proposed aggregate pavement base 2 thickness. If greater than zero, Aggbase 1 will be drawn as a Stabilized Permeable Base.

EXAMPLE: Go to: Aggregate Base Details; Rock Base Details

```
if (Sta >= 0+00 R 1)
    {
        _d_Aggbase2Thickness = 0/12
    }
```

_d_RockFillBaseThickness

Proposed rock fill base thickness. Go to: Rock Base Details

For an example see _d_Aggbase2Thickness. The only difference is the name of the variable.

_d_CompensatingDepth

Proposed compensating depth measured from the top of the proposed pavement. Go to: Compensating Depth Details

For an example see _d_Aggbase2Thickness. The only difference is the name of the variable.

Roadside Features Thickness Redefinable Variables

The roadside features thickness redefinable variables determine the thickness for various non-roadway items. All values are in positive. This number **MUST** be greater than zero.

_d_SidewalkThickness

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

Provides the thickness of the proposed sidewalk.

EXAMPLE: Go to: Sidewalk Thickness Details

```
if (Sta >= 0+00 R 1)
    {
        _d_SidewalkThickness = 4/12
    }
```

_d_PavedDitchThickness

Used by the Proposed Paved Ditches typical section (PDitch).

This is the total thickness of the proposed paved ditches from the top of proposed ground to the bottom of the paved ditch.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_PavedDitchThickness = 6/12
    }
```

Underdrain Dimension Redefinable Variables

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

The underdrain dimension redefinable variables control the size of the underdrains shown in cross section. The values **MUST** be in positive master units. See MoDOT Standard Plan 605.10

_d_UnderdrainHeight

Proposed underdrain height as measured from the bottom of the pavement.

EXAMPLE: Go to: Under Drain Details

```
if (Sta >= 0+00 R 1)
    {
        _d_UnderdrainHeight = 12/12
    }
```

_d_UnderdrainWidth

Proposed underdrain width.

EXAMPLE: Go to: Under Drain Details

```
if (Sta >= 0+00 R 1)
    {
        _d_UnderdrainWidth = 1
    }
```

Standard Curb Dimension Redefinable Variable

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

The curb dimension redefinable variable controls the height of the curb shown in cross section. The values **MUST** be in positive master units. See MoDOT Standard Plan 609.00

_d_IntegralCurbHeight

Proposed curb height for type A, B, & S curbs only. It is the distance up from the gutter line to the top of the curb.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_IntegralCurbHeight = 6/12
    }
```

Go to: Type S Separated Barrier Curb
Type A Integral Barrier Curb
Type B Integral Barrier Curb

Nonstandard Curb & Gutter Redefinable Variables

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

Important: Theses curb dimension redefinable variables are used only for nonstandard curb and gutters that do not conform to MoDOT Standard Plan 609.00. They are not to be used on state routes and are only provided to allow for cross sections to be drawn using municipal and other entity's standards.

_d_GutterSlope

Defined the slope of the top of gutter in percent format. Do not include the percent sign.

EXAMPLE:

Go to: User Defined Curb & Gutter

```
if (Sta >= 0+00 R 1)
    {
        _d_GutterSlope = -5.2
    }
```

_d_GutterWidth

Total width of curb and gutter in master units.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_GutterWidth = 2
    }
```

_d_CurbFaceWidth

The horizontal width of curb face in master units as measured from the gutter line to the start of the top of the curb.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_CurbFaceWidth = 2/12
    }
```

Nonstandard Curb & Gutter Redefinable Variables (continued)

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

_d_TopCurbWidth

The width of the top of the curb in master units as measured from the face to the back of the curb.

EXAMPLE:
```
if (Sta >= 0+00 R 1)
    {
        _d_TopCurbWidth = 6/12
    }
```

Go to: User Defined Curb & Gutter

_d_CurbHeight

The height of the curb in master units as measured from the gutter line to the top of the curb.

EXAMPLE:
```
if (Sta >= 0+00 R 1)
    {
        _d_CurbHeight = 6.17/12
    }
```

_d_GutterThickness

The thickness of the gutter in master units measured at the roadway face of the gutter.

EXAMPLE:
```
if (Sta >= 0+00 R 1)
    {
        _d_CurbHeight = 6.17/12
    }
```

_d_GutterBaseSlope

Defines the slope of the bottom of the gutter in percent format. Do not include the percent sign.

EXAMPLE:
```
if (Sta >= 0+00 R 1)
    {
        _d_GutterSlope = -5.2
    }
```

Raised Median Redefinable Variables

Used by divided pavement typical sections (DNPavt, DRecon, NLtRRt, & NRtRLt).

The raised median redefinable variables control how a raised median between curbs is drawn. They are used for Type 5 medians. The values **MUST** be in positive master units. See PDM Section 4-04.5 for design information on medians.

_d_PavedMedianThickness

Controls the thickness of paved medians when the width of median is less than _d_MaxPavedMedianWidth.

EXAMPLE:

Go to: _s_MedianType
Appendix 11 Medians

```
if (Sta >= 0+00 R 1)
    {
        _d_PavedMedianThickness = 6/12
    }
```

_d_MaxPavedMedianWidth

Controls the maximum width of a paved median. Any median width greater than this is drawn as a grass median.

EXAMPLE:

Go to: _s_MedianType
Appendix 11 Medians

```
if (Sta >= 0+00 R 1)
    {
        _d_MaxPavedMedianWidth = 10
    }
```

Entrance Dimension Redefinable Variables

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

The entrance dimension redefinable variables control the way entrances are drawn in cross section. The values **MUST** be in positive master units greater than zero. See MoDOT Standard Plans 203.61-203.65.

_d_EntrancePadWidth

Defines the distance from the edge of pavement to the entrance break point. If it less than the shoulder width, the shoulder width is used.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_EntrancePadWidth = 10
    }
```

_d_EntranceVertCurveLength

Defines the length of the vertical curve used for entrances. This variable is used only if the difference in slope between the entrance pad and the tie down to ground for type of entrance being drawn exceeds the maximum roll over slope as defined by the redefinable variables _d_Max_Type1_Roll_Over_Slope, _d_Max_Type2_Roll_Over_Slope, etc.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_EntranceVertCurveLength = 20
    }
```

Side Slope Redefinable Variables

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon), except as noted.

The side slope redefinable variables are used to define the slope of a side slope in Run:Rise format. Example, 6:-1. Make sure to include the colon. Include the negative sign before the **Rise** when applicable. The **Run** must always be positive.

_d_DitchForeSlope1_Left

Optional LEFT ditch fore slope 1 value. Rise is **ALWAYS** a negative number.

EXAMPLE: Go to: Ditch Fore Slope 1 Details

```
if (Sta >= 0+00 R 1)
    {
        _d_DitchForeSlope1_Left = 6:-1
    }
```

_d_DitchForeSlope1_Right

Optional RIGHT ditch fore slope 1 value. Rise is **ALWAYS** a negative number.

EXAMPLE: Go to: Ditch Fore Slope 1 Details

```
if (Sta >= 0+00 R 1)
    {
        _d_DitchForeSlope1_Right = 6:-1
    }
```

_d_DitchForeSlope2_Left

Required LEFT ditch fore slope 2 value. Rise is **ALWAYS** a negative number.

EXAMPLE: Go to: Ditch Fore Slope 2 Details

Special Ditch Options

```
if (Sta >= 0+00 R 1)
    {
        _d_DitchForeSlope2_Left = 6:-1
    }
```

_d_DitchForeSlope2_Right

Required RIGHT ditch fore slope 2 value. Rise is **ALWAYS** a negative number.

EXAMPLE: Go to: Ditch Fore Slope 2 Details

Special Ditch Options

```
if (Sta >= 0+00 R 1)
    {
        _d_DitchForeSlope2_Right = 6:-1
    }
```

_d_DitchBackSlope_Left

Required LEFT ditch back slope value. Rise is **ALWAYS** a positive number.

EXAMPLE: Go to: Ditch Back Slope Details

```
if (Sta >= 0+00 R 1)
    {
        _d_DitchBackSlope_Left = 3:1
    }
```

_d_DitchBackSlope_Right

Required RIGHT ditch back slope value. Rise is **ALWAYS** a positive number.

EXAMPLE: Go to: Ditch Back Slope Details

```
if (Sta >= 0+00 R 1)
    {
        _d_DitchBackSlope_Right = 3:1
    }
```

Side Slope Redefinable Variables (continued)

_d_FillSlope1_Left

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). Optional LEFT Fill Slope 1 value. Rise is **ALWAYS** a negative number.

EXAMPLE: Go to: Fill Slope 1 Details

```
if (Sta >= 0+00 R 1)
    {
        _ _d_FillSlope1_Left = 6:-1
    }
```

_d_FillSlope1_Right

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). Optional RIGHT Fill Slope 1 value. Rise is **ALWAYS** a negative number.

EXAMPLE: Go to: Fill Slope 1 Details

```
if (Sta >= 0+00 R 1)
    {
        _d_FillSlope1_Right = 6:-1
    }
```

_d_FillSlope2_Left

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). Required LEFT fill slope 2 value. Rise is **ALWAYS** a negative number.

EXAMPLE: Go to: Fill Slope 2 Details

```
if (Sta >= 0+00 R 1)
    {
        _d_FillSlope1_Right = 3:-1
    }
```

_d_FillSlope2_Right

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). Required RIGHT fill slope 2 value. Rise is **ALWAYS** a negative number.

EXAMPLE: Go to: Fill Slope 2 Details

```
if (Sta >= 0+00 R 1)
    {
        _d_FillSlope1_Right = 3:-1
    }
```

_d_MedianSlope2

Used by divided pavement typical sections only (DNPavt, DRecon, NLtRRt, & NRtRLt).

It is required and represents the slope beyond the shoulder or curb within the median when no median slope 1 is used. If a median slope 1 is used, this slope will begin at the end of the median slope 1. It is used for median types 1 and 2 only. Rise is **ALWAYS** a negative number.

EXAMPLE: Go to: Appendix 11 Medians

```
if (Sta >= 0+00 R 1)
    {
        _d_MedianSlope2 = 5.5:-1
    }
```

Ditch Dimension Redefinable Variables

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon), except as noted.

The ditch dimension redefinable variables control the way ditches are drawn in cross section. Values are in master units. Depths are considered positive and **MUST** be greater than zero. Widths may be zero for a "V" ditch or greater than zero for a flat bottom ditch.

_d_StandardDitchDepth_Left

Controls the depth of the LEFT standard ditch as measured from the edge of shoulder, back of curb or edge of berm.

EXAMPLE: if (Sta >= 0+00 R 1) Go to: Standard Ditch Depth

```
{
    _d_StandardDitchDepth_Left = 4
}
```

_d_StandardDitchDepth_Right

Controls the depth of the RIGHT standard ditch as measured from the edge of shoulder, back of curb or edge of berm.

EXAMPLE: if (Sta >= 0+00 R 1) Go to: Standard Ditch Depth

```
{
    _d_StandardDitchDepth_Right = 4
}
```

_d_DitchWidth_Left

Controls the width of LEFT standard ditch.

EXAMPLE: if (Sta >= 0+00 R 1) Go to: Ditch Width

```
{
    _d_DitchWidth_Left = 8
}
```

_d_DitchWidth_Right

Controls the width of RIGHT standard ditch.

EXAMPLE: if (Sta >= 0+00 R 1) Go to: Ditch Width

```
{
    _d_DitchWidth_Right = 8
}
```

_d_StdMedianDitchDepth

Used by divided pavement typical sections only (DNPavt, DRecon, NLtRRt, & NRtRLt). Controls the depth of median standard ditches as measured from the edge of shoulder or back of curb and is used for median types 1 and 3 only.

EXAMPLE: if (Sta >= 0+00 R 1) Go to: Medians

```
{
    _d_StdMedianDitchDepth = 4
}
```

_d_MedianDitchWidth

Used by divided pavement typical sections only (DNPavt, DRecon, NLtRRt, & NRtRLt). Controls the width of median standard ditches. This value is used for median types 2 and 3 only.

EXAMPLE: if (Sta >= 0+00 R 1) Go to: Medians

```
{
    _d_MedianDitchWidth = 8
}
```

Force Closed Slope Redefinable Variables

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

The force closed slope redefinable variables allow the user to force slope closure to a specific offset or at a slope other than the standard slope. To control this behavior, set the ForcedClosingSlopes variable to either ^Yes^ or ^No^ for each side. When set to no, normal side slope conditions are used. When set to yes the slope is drawn from the edge of the shoulder or curb directly to the ground. The carets "^" are required.

The closure can be controlled by either a plan view element or a forced slope variable. If a plan view element is drawn representing the location of the forced slope tie, then the plan element will take precedence and control the location of the tie. If the plan element is not found, variables are used to locate the tie. If the section is in cut the ForcedCutSlope value for that side is used and if the section is in fill the ForcedFillSlope value for that side is used.

The closure can be controlled by either a plan view element or a forced slope variable. If a plan view element is drawn representing the location of the forced slope tie, then the plan element will take precedence and control the location of the tie. If the section is in cut the ForcedCutSlope value for that side is used and if the section is in fill the ForcedFillSlope value for that side is used.

The forced slope value is in Run:Rise format. Run is ALWAYS a positive number. Rise is ALWAYS a positive number in CUT and ALWAYS a negative number in FILL (Example, 2:-1). Make sure to include the colon.

_s_LeftForceClosingSlopes

Used to force closing of LEFT side slopes.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _s_LeftForceClosingSlopes = ^No^
    }
```

_s_RightForceClosingSlopes

Used to force closing of RIGHT side slopes.

For an example see _s_LeftForceClosingSlopes. The only difference is the name of the variable.

Go to: Forced Closure using Redefinable Variables

Force Closed Slope Redefinable Variables (continued)

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

_d_LeftForcedCutSlope

Optional LEFT forced cut slope value.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_LeftForcedCutSlope = 2:1
    }
```

_d_RightForcedCutSlope

Optional RIGHT forced cut slope value.

For an example see _d_LeftForcedCutSlope. The only difference is the name of the variable.

_d_LeftForcedFillSlope

Optional LEFT forced fill slope value.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_LeftForcedFillSlope = 2:-1
    }
```

_d_RightForcedFillSlope

Optional RIGHT forced fill slope value.

For an example see _d_LeftForcedFillSlope. The only difference is the name of the variable.

Go to: Forced Closure using Redefinable Variables

Right of Way Constrained Slope Redefinable Variables

The right of way constrained closing slope redefinable variables are used to force the slope to tie at or inside of the right of way line. An optional buffer distance from the right of way line may also be used. If the normal slope can fit within the right of way and buffer distance, a normal slope is used. If the normal slope will not fit within right of way and buffer distance, a steeper slope is drawn and labeled as such. This will allow the user to identify when the slopes were drawn steeper than the defaults.

_s_LeftROWConstrainedSlope

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). ^Yes^ or ^No^ to force the LEFT slope to tie inside of the allowed right of way.

EXAMPLE:
```
if (Sta >= 0+00 R 1)
    {
        _s_LeftROWConstrainedSlope = ^No^
    }
```

_s_RightROWConstrainedSlope

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). ^Yes^ or ^No^ to force the RIGHT slope to tie inside of the allowed right of way.

EXAMPLE:
```
if (Sta >= 0+00 R 1)
    {
        _s_RightROWConstrainedSlope = ^No^
    }
```

_d_ROW_Buffer_Width

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). Provides a minimum buffer distance in master units when forcing the side slope tie down point inside of the right of way.

EXAMPLE:
```
if (Sta >= 0+00 R 1)
    {
        _d_ROW_Buffer_Width = 1
    }
```

Go to: Right of Way Constrained Slopes Cross-Section Details

Rock Benching Redefinable Variables

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

The rock benching redefinable variables are used to draw side slope benches in cross section. For additional information on using these redefinable variables go to: Appendix 13 Rock Benches.

_d_BenchingBackSlope

Rock benching backslope value in Run:Rise format. Rise is ALWAYS a positive number.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_BenchingBackSlope = .1:1
    }
```

_d_BenchHeight

Defines the rock bench height in master units. Once this value is exceeded, a new bench is drawn. This is a positive value and **MUST** be greater than zero.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_BenchHeight = 30
    }
```

_d_BenchWidth

Defines the rock bench width in master units. This is a positive value and **MUST** be greater than zero.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_BenchWidth = 10
    }
```

_s_TopBenchWidth

Defines the width of the top bench, which can either be to a line defined by the angle of repose or a specified width in master units. Set to ^RS^ for angle of repose slope or put in a number to specify a width --> i.e. ^10^. The carets "^" are required.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _s_TopBenchWidth = ^10^
    }
```

Interception Ditch and Levee Redefinable Variables

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

The Levee and Optional Interception Ditch redefinable variables are used to draw an interception ditch and / or levee in cross section.

_s_LeveeAdjacentToDitch

^Yes^ or ^No^ to control whether the optional levee is adjacent to the proposed ditch or if it is separated. If set to ^Yes^, the levee starting point will coincide with the tie point of the backslope of the proposed ditch. If set to ^No^, the levee will be drawn if top of levee inside and outside edges are found in the defined GEOPAK Lines DGN.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _s_LeveeAdjacentToDitch = ^No^
    }
```

_d_LeveeHeight

Defines the height of the optional levee in mater units as measured (1) from the existing ground if an interception ditch profile is not defined for the cross section station or (2) from the interception ditch profile if it exists.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_LeveeHeight = 3
    }
```

_d_LeveeForeslope

Optional levee fore slope in Run:Rise format. Run and Rise are ALWAYS a positive number.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_LeveeForeslope = 2:1
    }
```

Interception Ditch and Levee Redefinable Variables (continued)

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

_d_LeveeBackslope

Optional levee backslope value in Run:Rise format. Rise is ALWAYS a negative number.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_LeveeBackslope = 2:-1
    }
```

_d_InterceptionDitchWidth

Optional levee interception ditch width in master units. This is a positive value and **MUST** be greater than zero.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_InterceptionDitchWidth = 2
    }
```

_d_InterceptionDitchBackslope

Optional levee interception ditch backslope value in Run:Rise format. Rise is ALWAYS a positive number. Example, 2:1. Make sure to include the colon.

EXAMPLE:

```
if (Sta >= 0+00 R 1)
    {
        _d_InterceptionDitchBackslope = 2:1
    }
```

Go to: Levee and Optional Interception Ditch

Retaining Wall Redefinable Variables

Used by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

The retaining wall dimension redefinable variables control the way walls are drawn in cross section. The values **MUST** be in positive master units greater than zero unless noted otherwise.

_d_WallWidth

Defines the width of the wall.

```
EXAMPLE:    if (Sta >= 0+00 R 1)
                {
                    _d_WallWidth = 1
                }
```

_d_TotalFootingWidth

Defines the total width of the footing (toe to the heel distance).

```
EXAMPLE:    if (Sta >= 0+00 R 1)
                {
                    _d_TotalFootingWidth = 7
                }
```

_d_KeyWidth

Defines the width of the footing key.

```
EXAMPLE:    if (Sta >= 0+00 R 1)
                {
                    _d_KeyWidth = 1
                }
```

_d_KeyHeight

Defines the height of the retaining wall footing key.

```
EXAMPLE:    if (Sta >= 0+00 R 1)
                {
                    _d_KeyHeight = 2
                }
```

_d_FootingThickness

Defines the thickness of the retaining wall footing.

```
EXAMPLE:    if (Sta >= 0+00 R 1)
                {
                    _d_FootingThickness = 1.5
                }
```

_d_BackFootingWidth

Defines the width of the footing behind the wall (the distance from the back of the wall to the footing heel).

```
EXAMPLE:    if (Sta >= 0+00 R 1)
                {
                    _d_BackFootingWidth = 4.5
                }
```

_d_KeyOffset

Defines the footing key offset (Distance from the footing toe to the front of the key).

```
EXAMPLE:    if (Sta >= 0+00 R 1)
                {
                    _d_KeyOffset = 1.5
                }
```

Go to: Footing Cross-Section Details

Retaining Wall Redefinable Variables (continued)

_s_WallHeight

Either the ground surface (existing or proposed) OR a fixed value may define the height of the wall. The options are:

^GS^ = Use existing and proposed ground surfaces; or ^10^ for a 10 foot high wall. ALWAYS use carets.

```
EXAMPLE:        if (Sta >= 0+00 R 1)
                    {
                        _s_WallHeight = ^GS^
                }
```

_d_DepthBelowProposedGroundInCut

Defines the distance the top of the footing is below proposed ground in cut.

```
EXAMPLE:
            if (Sta >= 0+00 R 1)
                {
                    _d_DepthBelowProposedGroundInCut = 2
                }
```

_d_DepthBelowExistGroundInFill

Defines the distance from existing ground to top of footing in fill.

```
EXAMPLE:
            if (Sta >= 0+00 R 1)
                {
                    _d_DepthBelowExistGroundInFill = 2
                }
```

Go To: DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon

_d_BackWallHeightInCut

Defines the height of the retaining wall footing back wall.

```
EXAMPLE:
            if (Sta >= 0+00 R 1)
                    {
                        _d_BackWallHeightInCut = 0.5
                }
```

_d_HeightAboveExistGroundInCut

Defines the distance from existing ground to the top of the wall in cut.

```
EXAMPLE:
            if (Sta >= 0+00 R 1)
                {
                    _d_HeightAboveExistGroundInCut = 0
                }
```

_d_HeightAbovePropGroundInFill

Defines the height of the wall above proposed ground in fill.

```
EXAMPLE:
            if (Sta >= 0+00 R 1)
                {
                    _d_TotalFootingWidth = 7
                    }
```

Go to: Footing Cross-Section Details
Height Set by Elevation of the Top of the Wall
Height Set by a Fixed Value
Height Varies With the Ground Surface

Appendix 4 Existing Features

Roadway

Existing Pavement

Drawn by Existing Features Typical Section (ExFeat).

For the existing pavement to be drawn in the cross section, an Existing Edge of Pavement must be drawn in the designated Existing TOPO DGN. The symbology must match the search criteria for that **D&C Manager** item. Both edges of the pavement must cross the pattern line for it to be drawn correctly. It is recommend that any existing edges of pavement that are not to be used for showing existing pavement in the cross section view be placed in a DGN other than the one defined as the Existing TOPO DGN.

The thickness (in master units) shown in the cross-section is controlled by the redefinable variable _d_ExistPavtThick.

Example

Existing TOPO DGN view

Cross-Section View

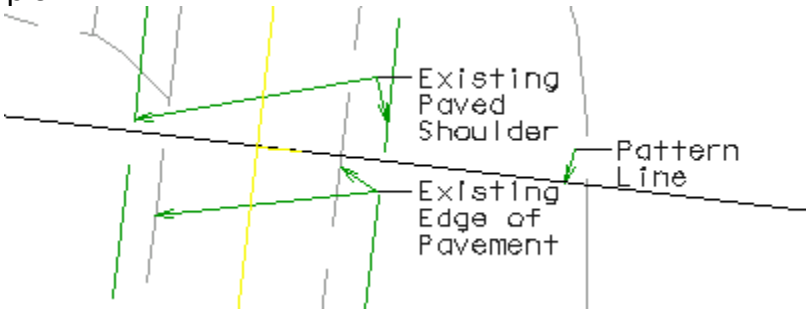
Existing Paved Shoulder

Drawn by Existing Features Typical Section (ExFeat).

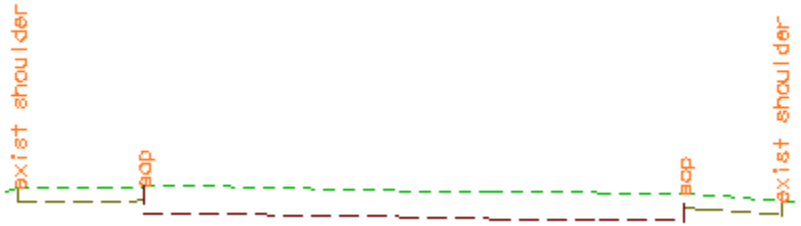
For the existing paved shoulder to be drawn in the cross section, an Existing Paved Shoulder line must be drawn in the designated Existing TOPO DGN at the outside edge of the shoulder and the redefinable variable _s_ShowShoulders must be set to ^yes^ for the current station. The symbology must match the search criteria for that **D&C Manager** item. It must be on the outside of the corresponding Existing Edge of Pavement line since the paved shoulder will be drawn from the existing edge of pavement to the existing edge of shoulder as shown the figures below.

The thickness (in master units) shown in the cross-section is controlled by the redefinable _d_ExistShouldThick.

Example



Topo View



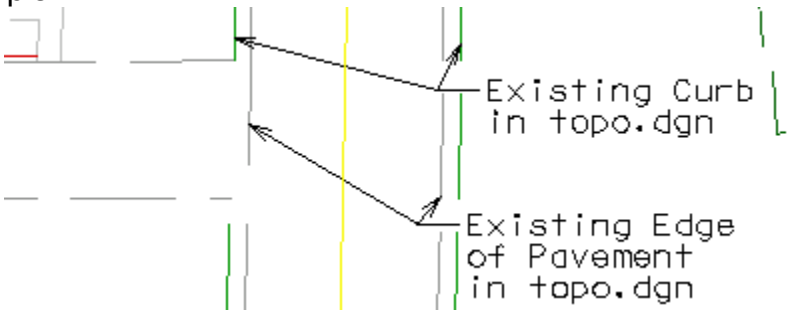
Cross-Section View

Existing Curb and Gutter

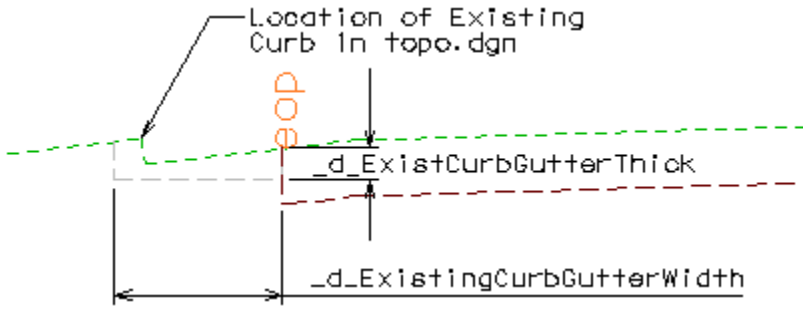
Drawn by Existing Features Typical Section (ExFeat).

For the existing curb to be drawn in the cross section, an Existing Curb line (matching the search criteria for that **D&C Manager** item) must be drawn in the designated Existing TOPO DGN outside of an Existing Edge of Pavement line within the allowable search distance set by _d_CurbSearchDistance. In addition, the redefinable variable _s_ShowCurbandGutter must be set to ^yes^ for the current station. The Existing Curb line only indicates the presence of an existing curb. It **does not** indicate the offset of the curb. Rather, the existing curb is drawn using the following parameters: The Existing Edge of Pavement line determines the inside edge of the curb or curb & gutter (this point is marked with the text 'eop' in the cross section views in the figures shown below); _d_ExistCurbGutterThick determines the depth of the inside face, as measured down from the top of the existing surface (see the upper right cross section view); _d_ExistCurbGutterWidth locates the back of the curb as measured out from the edge of pavement (see the upper right cross section view); a vertical line is drawn from that point to existing ground. In most cases **the user will need to manually place the existing edge of pavement line** at the proper location for the criteria to work. If the existing curb line already exists in the drawing, the easiest way to place the existing edge of pavement line is to offset the existing curb line by the appropriate distance using the MicroStation **Copy Parallel** tool with the Existing Edge of Pavement line selected in **D&C manager** and **Place Influence** activated.

Example



Topo View



Cross-Section View

_d_ExistingCurbGutterThick
= _d_ExistPavedDitchThick

_d_ExistingCurbGutterThick
< _d_ExistPavedDitchThick

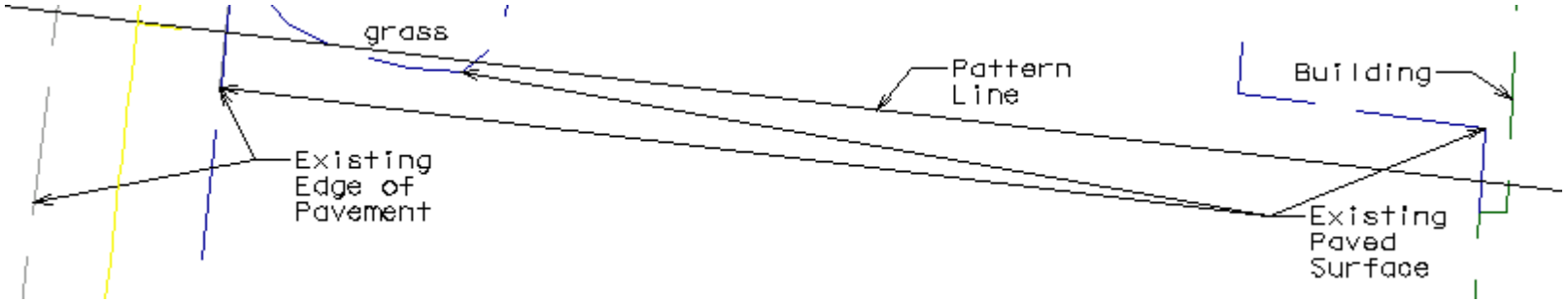
Existing Paved Surfaces

Drawn by Existing Features Typical Section (ExFeat).

For existing paved surfaces to be drawn in the cross section, Existing Paved Surface lines must be drawn in the designated Existing TOPO DGN and the redefinable variable _s_ShowPavedSurface must be set to ^yes^ for the current station. The symbology must match the search criteria for that **D&C Manager** item. Both edges of the existing paved surface must cross the pattern line for it to be drawn correctly. It is recommend that any existing paved surface lines that are not to be used for showing existing paved surface in the cross section view be placed in a DGN other than the one defined as the Existing TOPO DGN.

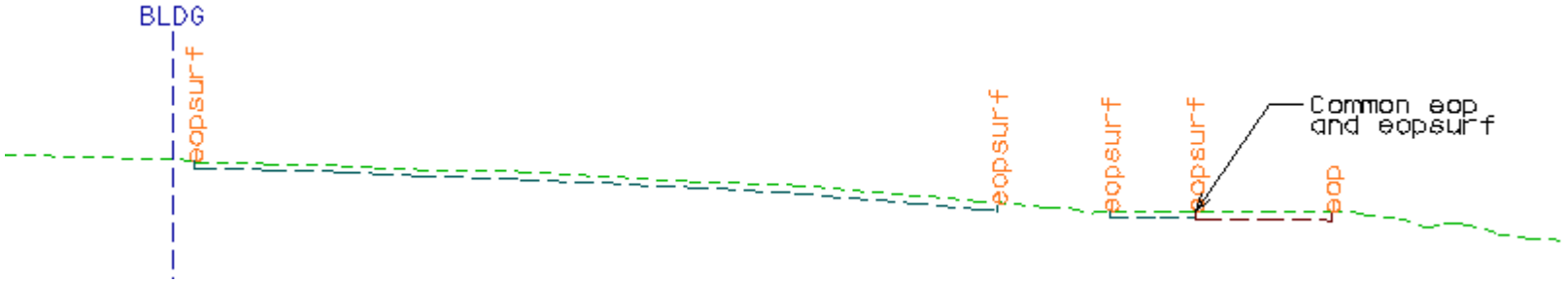
The thickness (master units) shown in the cross-section is controlled by the redefinable variable _d_ExistPavedSurfaceThick.

Example



Topo View

(The existing edge of pavement and the existing paved surface lines are plotted on top of each other at their common location)



Cross-Section View

Roadside

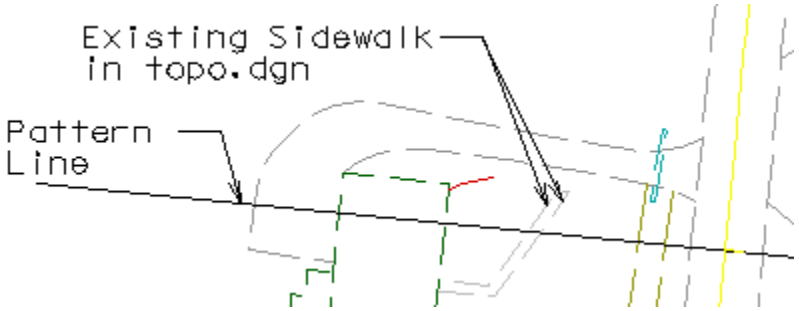
Existing Sidewalks

Used by Existing Features Typical Section (ExFeat).

For an existing sidewalk to be drawn in the cross section, Existing Sidewalk lines must be drawn in the designated Existing TOPO DGN and the redefinable variable _s_ShowSidewalk must be set to ^yes^ for the current station. The symbology must match the search criteria for that **D&C Manager** item. Both edges of the sidewalk must cross the pattern line for it to be drawn correctly.

The thickness (in master units) shown in the cross-section is controlled by the redefinable variable _d_ExistSidewalkThick.

Example



Topo View

Cross-Section View

Drainage

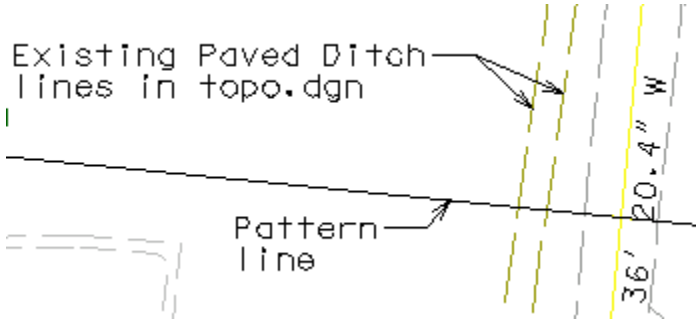
Existing Paved Ditches

Drawn by Existing Features Typical Section (ExFeat).

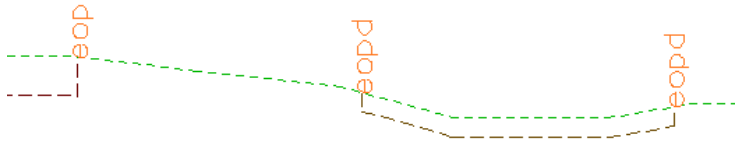
For existing paved ditches to be drawn in the cross section, Existing Paved Ditch lines must be drawn in the designated Existing TOPO DGN and the redefinable variable _s_ShowPavedDitch must be set to ^yes^ for the current station. The symbology must match the search criteria for that **D&C Manager** item. Both edges of the existing paved ditch must cross the pattern line for it to be drawn correctly.

The thickness (in master units) shown in the cross-section is controlled by the redefinable variable _d_ExistPavedDitchThick.

Example:



Topo View



Cross-Section View

Property

Existing Buildings

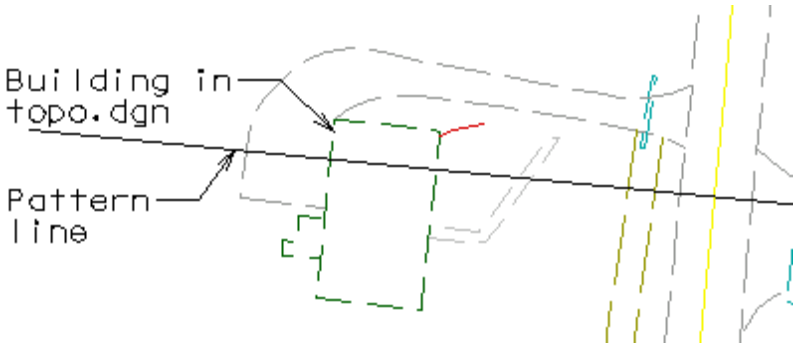
Marked by Existing Features Typical Section (ExFeat).

For existing building edges to be marked in the cross sections; Existing Building lines must be drawn in the designated Existing TOPO DGN and the redefinable variable _s_ShowBuildings must be set to ^yes^ for the current station. The symbology must match the search criteria for that **D&C Manager** item.

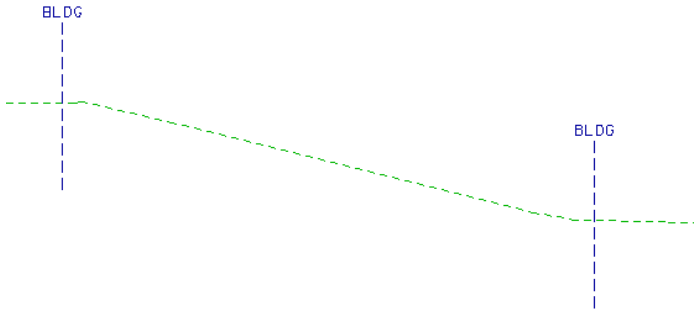
The height of the line shown in the cross-section is controlled by the redefinable variable _d_ExistingFeatureLineHeight, which is specified in master units.

The variable XS Scale controls the size of the text “BLDG”.

Example



Topo View



Cross-Section View

Utilities

Existing Railroads

Marked by Existing Features Typical Section (ExFeat).

For the center line of existing railroad tracks to be marked in the cross sections; Existing Railroad lines must be drawn in the designated Existing TOPO DGN and the redefinable variable _s_ShowRailroadTracks must be set to ^yes^ for the current station. The symbology must match the search criteria for that **D&C Manager** item.

The height of the line shown in the cross-section is controlled by the redefinable variable _d_ExistingFeatureLineHeight, which is specified in master units.

The variable XS Scale controls the size of the text “EX_RR”.

Example

Safety and Structures

Existing Wall

Marked by Existing Features Typical Section (ExFeat).

For existing retaining walls to be marked in the cross sections; Existing Wall lines must be drawn in the designated Existing TOPO DGN and the redefinable variable _s_ShowRetainingWall must be set to ^yes^ for the current station. The symbology must match the search criteria for that **D&C Manager** item.

The height of the line shown in the cross-section is controlled by the redefinable variable _d_ExistingFeatureLineHeight, which is specified in master units.

The variable XS Scale controls the size of the text “EX_WALL”.

Example

Appendix 5 Pavement

Drawn by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

Pavement

Up to seven different layers may be drawn within the pavement structure. They are four pavement layers (bituminous or concrete), two aggregate sub base layers and a rock fill base layer. Only the first pavement layer is required to have a value other than zero. In addition, a compensating depth line may be drawn. Lastly, optional underdrains may be shown on the cross-sections.

Edge of Pavement lines must be drawn in the designated Proposed Plan DGN for new pavement to be drawn in the cross sections.

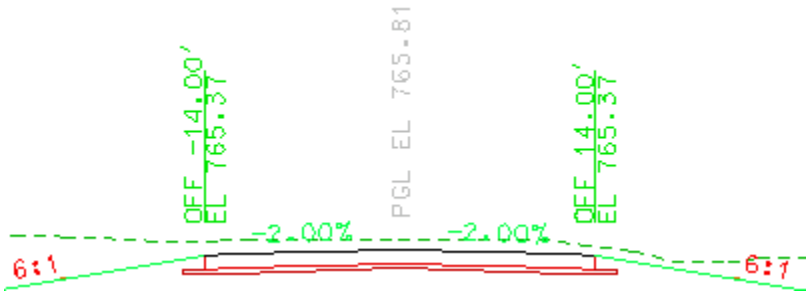
How the pavement is closed is controlled by the redefinable variable _s_PavementType, which must be set to either ^C^ for concrete pavement with a vertical closure or to ^B^ for bituminous pavement with a 1:1 closure.

The redefinable variable _d_NormalPavementSlope defines the normal pavement slope in percent on tangent sections. This is typically a -2 percent or similar. This value directly affects the way super elevation transitions are handled. It represents normal pavement crown slope when no super elevation is present. Do not include the percent sign. Do include the negative sign when applicable. The superelevation slope is obtained from the shape cluster in the DGN defined in the Shapes section of the Proposed Cross-Section run.

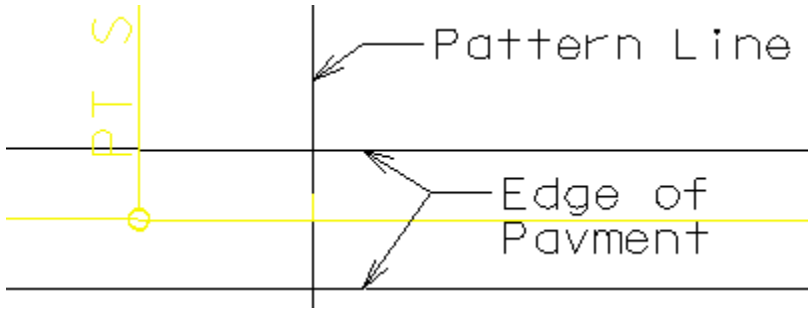
Concrete Pavement

Since concrete pavement typically has only one layer of pavement, the redefinable variable _d_PavementLayer1Thick is set to the full pavement depth in master units. The bottom aggregate layer is drawn with the 18-inch extension as required by PDM section 6-03.7 paragraph (3).

Example



Cross-Section View

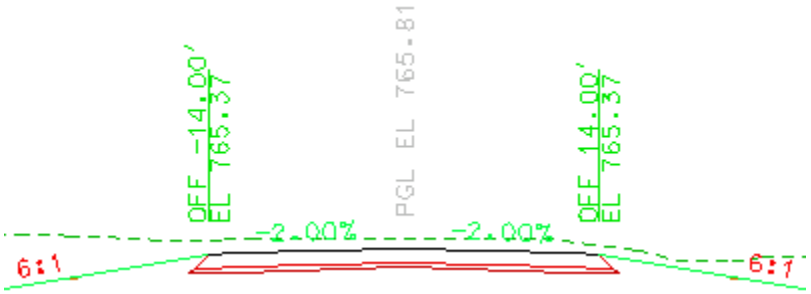


Proposed Plan View

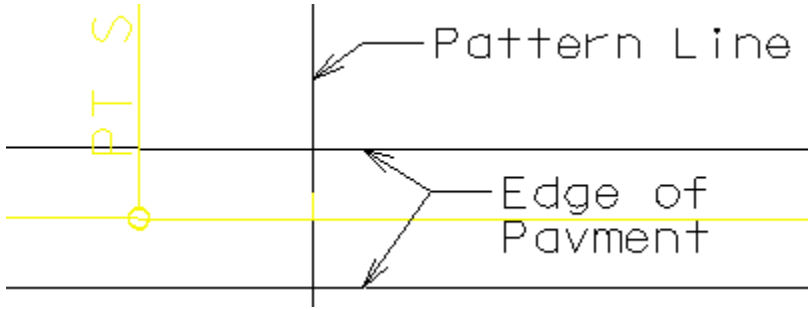
Bituminous Pavement

Bituminous pavement can be drawn as one layer by assigning the full pavement depth to _d_PavementLayer1Thick (in master units) and leaving the other pavement layer thickness variables set to zero (0), as shown in Example 1 below. It can also be drawn with up to four (4) layers using _d_PavementLayer1Thick, _d_PavementLayer2Thick, _d_PavementLayer3Thick, and _d_PavementLayer4Thick for the top through bottom layers respectively, as shown in Example 2. See PDM Sec 6-03.4 for more information on pavement layer thicknesses for flexible (bituminous) pavement design. Any aggregate layers have a 1:1 closure.

Example 1

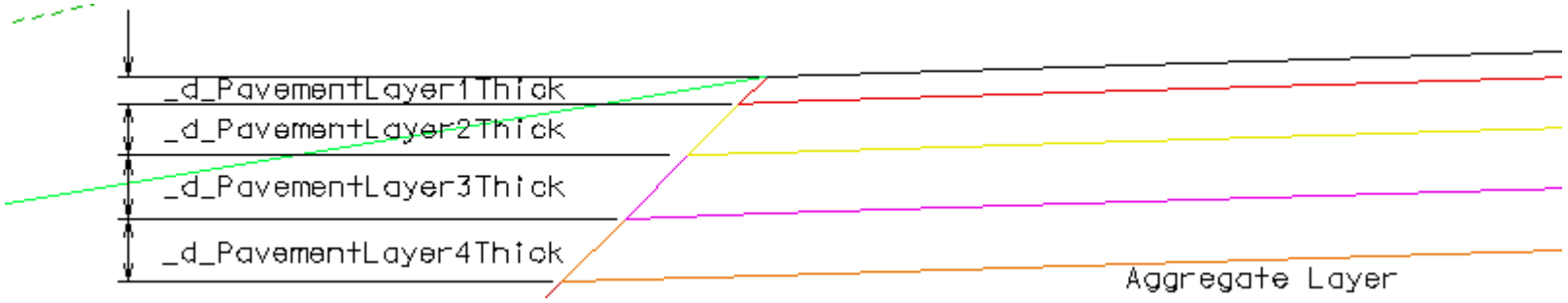


Cross-Section View



Proposed Plan View

Example 2



Cross-Section View Showing Possibility of Having Up To Four (4) Pavement Layers

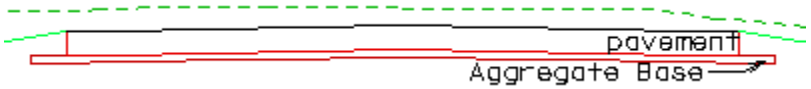
Base Considerations

The pavement base material can be drawn using either an aggregate or a rock base. See PDM Section 6-03.7 for a full discussion of which base should be used for a project. The information provided here relates only to how the criteria draw the base, not which base should be used.

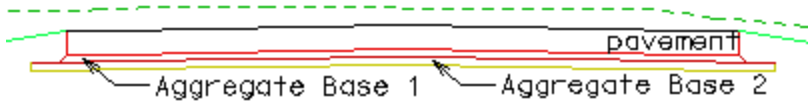
Aggregate Base

One or two aggregate base layers may be drawn. If values greater than zero are assigned to both _d_Aggbase1Thickness and _d_Aggbase2Thickness, two layers will be drawn and the upper layer will be drawn as a permeable base. If only one layer is needed, _d_Aggbase1Thickness must be greater than zero and _d_Aggbase2Thickness must be set to zero. All values are in master units.

Example 1: Aggregate base under concrete (rigid) pavement



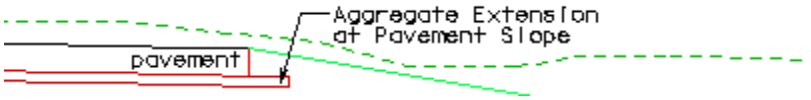
Cross-Section View of One Aggregate Base



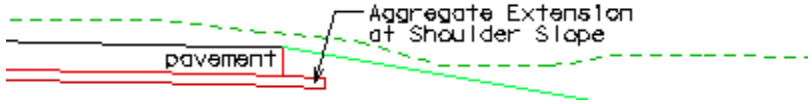
Cross-Section View of Two Aggregate Bases

Example 2: Aggregate base extension under concrete (rigid) pavement

For concrete pavement, the 18” aggregate extension can either be drawn at the pavement or the shoulder slope, as determined by the setting for the redefinable variable _s_ExtensionSlope. Set it either to ^P^ for drawing the extension at the pavement slope or to ^S^ for drawing the extension at the shoulder slope. The carets "^" are required.

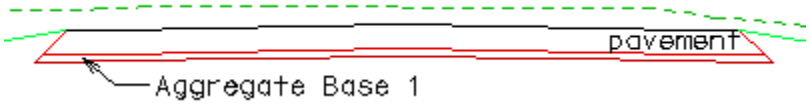


Aggregate Extension at Pavement Slope

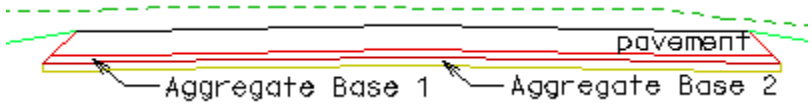


Aggregate Extension at Shoulder Slope

Example 3: Aggregate base under bituminous (flexible) pavement



Cross-Section View of One Aggregate Base



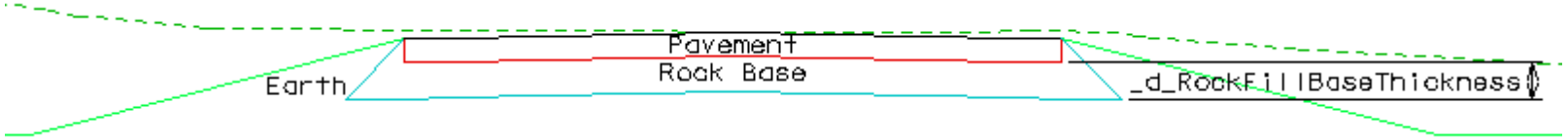
Cross-Section View of Two Aggregate Bases

Rock Base

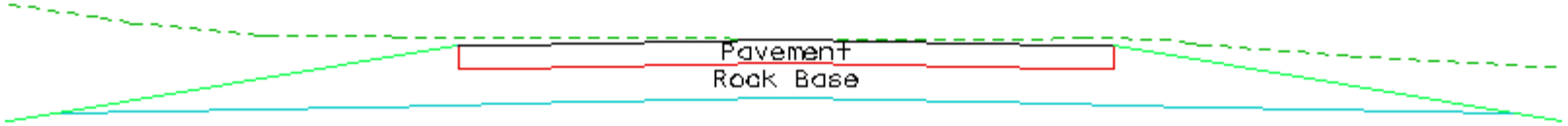
For the rock base to be drawn correctly, both _d_Aggbase1Thickness and _d_Aggbase2Thickness must be set to zero.

There are three redefinable variables that control how the rock base is drawn. The rock thickness as measured down from the bottom of the pavement in master units is set by _d_RockFillBaseThickness. Whether the rock base is daylighted on tangent sections and on the low side of super elevated sections is determined by _s_RockFillBaseDaylight (^Yes^ to daylight or ^No^ to not daylight). The last variable _s_RockFillBaseDaylightHSS determines if the rock base is to daylight on the high side of super elevated pavement, which according to current design practice should always be set to ^No^.

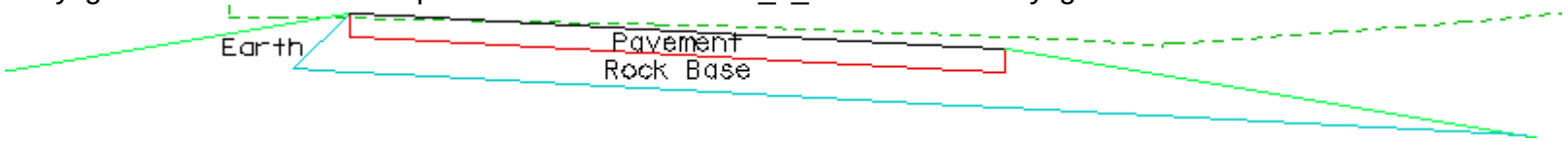
Example 1: Earth covered rock base on a superelevated section with _s_RockFillBaseDaylight set to ^No^.



Example 2: Daylighted rock base on a tangent section with _s_RockFillBaseDaylight set to ^Yes^.



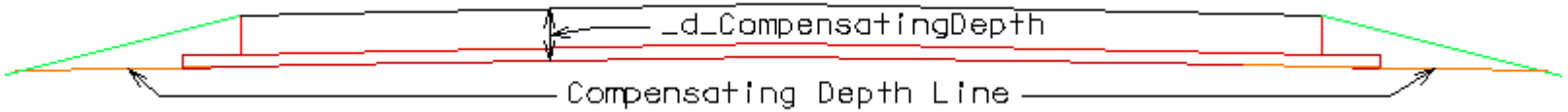
Example 3: Daylighted rock base on a superelevated section with _s_RockFillBaseDaylight set to ^Yes^.



Compensating Depth

A line can be drawn at a fixed distance below the pavement surface. This line is projected to proposed ground. To have this line included, set _d_CompensatingDepth to the desired depth in master units.

Example



Under Drain

The only underdrains drawn by the criteria are the pavement edge drains required for medium and heavy duty routes without a daylighted rock base. See PDM Section 6.02 and MoDOT Standard Plan 605.10 for further design information.

The two redefinable variables _s_DrawLeftUnderdrain and _s_DrawRightUnderdrain control whether or not edge drains are drawn on the left and right side respectively. Set the variables as ^Yes^ to draw the drain and as ^No^ to not draw them. Even if the variable is set to ^Yes^, the edge drain will **not** be drawn on the *high* side of super elevated pavement.

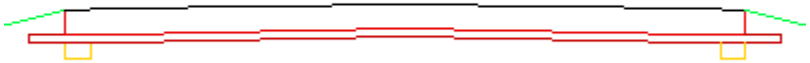
The width of the underdrain is determined by _d_UnderdrainWidth. Based on MoDOT Standard Plan 605.10, the width of an edge drain is always 1'; therefore leave this variable set to its default value of 1.

The depth of the drawn underdrain is controlled by the redefinable variable _d_UnderdrainHeight in master units and varies depending upon the number of aggregate layers, according to MoDOT Standard Plan 605.10. Each case is covered below:

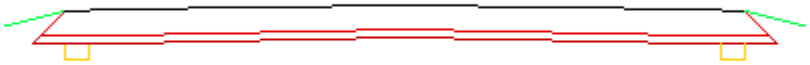
One Aggregate Layer

If there is one aggregate layer _d_UnderdrainHeight should be set to 8/12.

Example



Underdrain Under Concrete Pavement



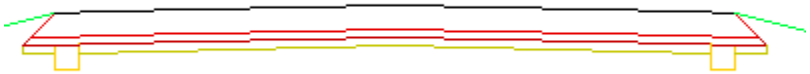
Underdrain Under Bituminous Pavement

Two Aggregate Layers

If there are two aggregate layers _d_UnderdrainHeight should be set to 12/12.

Example

Underdrain Under Concrete Pavement



Underdrain Under Bituminous Pavement

Appendix 6 Reconstruction

Drawn by pavement reconstruction typical sections (DRecon, NLtRRt, NRtRLt, & URECon).

The reconstruction criteria draw up to two overlay layers and an optional widening with bituminous or concrete pavement using either a "match existing" or "crown correction" approach, as controlled by the redefinable variables _s_OverlayType and _s_WideningSlope.

Up to two overlay layers may be drawn between either the Existing Edge of Pavement or Proposed Saw Cut lines. The thickness of these layers is controlled by the redefinable variables _d_OverlayThickness1 and _d_OverlayThickness2, respectively. In addition, up to seven different layers within the proposed widening pavement structure are allowed. Only the first pavement layer is required to have a value other than zero for both the overlay section as well as the full depth widening section. Four pavement layers, two optional aggregate sub base layers, and the optional proposed rock fill base layer may be drawn within the widening pavement structure. Lastly, optional underdrain may be shown on the cross-sections.

Proposed widening starts at a proposed saw cut line if this line is inside the proposed edge of pavement. If no saw cut line is found, proposed widening starts at the existing edge of pavement if this line falls inside the proposed edge of pavement. If neither line is found inside the proposed edge of pavement the overlay extends to the proposed edge of pavement with no full depth widening.

IMPORTANT: An even number of edges of existing pavement are required in the 2D Topo file. If a cross section pattern line crosses an odd number of existing edges of pavement the criteria will not process and an error message is drawn.

When the overlay type CC (crown correction) is chosen, shapes are used to provide cross slope information only. The shapes can be very narrow (such as two feet wide for example). The proposed profile required for the shapes is only used as a vertical reference if the variable _s_OverlayOffsetLocation is set to ^P^ for profile. If this variable is set to any other option, the proposed profile is ignored. If the profile is ignored, only a straight-line profile containing a beginning and ending VPI is required. Make sure that the elevations for the proposed profile are close to the elevations of the project. These shapes are sometimes referred to as "dummy" shapes. They are drawn onto the cross sections and need to be deleted after the cross sections are processed. They are simply being used to provide cross slope information for the widening. No vertical references are utilized from these shapes if _s_OverlayOffsetLocation = ^L^ or ^C^ or ^R^ for left, center, or right respectively. Instead, the existing ground at the location specified by this variable sets the top of the pavement elevation. However, if this variable is set to ^P^, the proposed profile is used to dictate the elevation of the top of pavement at the profile grade location.

When the overlay type ME (match existing) is chosen "dummy shapes" are still required. They are required for the criteria to process.

Appendix 7 Rural Shoulders

Drawn by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

For U1 Shoulders details see Curbing With Urban Shoulders (U1 & U2).

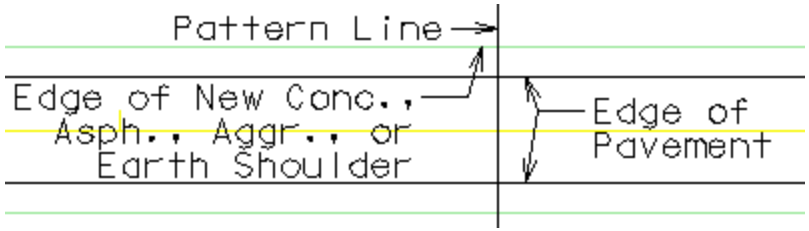
Determining Shoulder Width and Type

The width and type of shoulder can be specified in two different ways. They can be determined either by an edge of shoulder line in the Proposed Plan DGN or from redefinable variables.

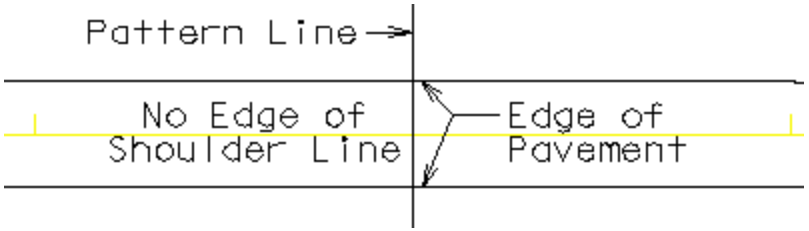
If used, the edge of shoulder lines must be drawn in the designated Proposed Plan DGN. The symbology must match the search criteria for the respective type of shoulder in the **D&C Manager**. To draw the lines use the D&C Manager items **EOS New Conc**., **EOS New Asph**., or **EOS New Aggr**., or **EOS New Earth** depending upon the type of shoulder to be drawn. These items are located in the D&C Manager path: "**Design Standards/Roadway/**". For the line to be recognized by the criteria, it must be located within the search distance specified by the redefinable variables _d_OutsideShoulderSearchDistance and _d_MedianShoulderSearchDistance in master units. This distance is measured from the proposed edge of pavement. This variable is required to avoid locating a plan view shoulder element from an adjacent or parallel roadway. This number MUST be greater than zero.

If an edge of shoulder line is not found within the applicable search distance, redefinable variables are used to determine the width and type of shoulder. The variables _d_OutsideShoulderWidth and _d_MedianShoulderWidth control the width (master units) of the shoulder; while the shoulder type is controlled by _s_OutsideShoulderType or _s_MedianShoulderType, which may be set to ^C^ for concrete, ^B^ for bituminous, ^A^ for aggregate, or ^E^ for earth shoulders. A plan element **ALWAYS** "overrides" these variables.

Example



Proposed Plan View with an Edge of Shoulder Line within Search Distance to Control Shoulder Width



Proposed Plan View without an Edge of Shoulder Line within Search Distance. Variable Controls Width

Shoulders In Cross Section

The user has the option of whether to label the edge of shoulder elevation and offset by setting the value for the redefinable variable _s_LabelShoulderElevations. Set it to either ^Yes^ or ^No^. Note that if the labels are drawn, they are drawn as part of graphic group to allow for easy manipulation. The carets "^" are required.

Five additional redefinable variables are provided to control how the shoulders are drawn in cross section. Their values need to be set by the user based on the type of shoulder drawn. The following sections give the values needed for the different types of shoulder used by MoDOT, based upon PDM Figures 6-03.1 thru 6-03.9. If the PDM should be updated, please use the values from the update rather than those given below.

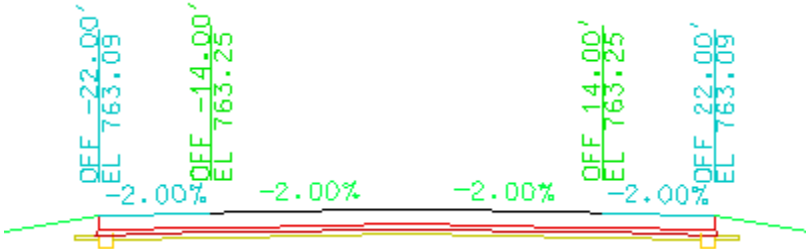
Type A and Type A1 Shoulders (Full Pavement Depth Shoulders)

Type A shoulder is used for all medium and heavy duty pavements as specified in PDM Figures 6-03.6 thru 6-03.9. Type A1 shoulder is used on all non-curbed medians (PDM Figures 6-03.4, 6-03.7, & 6-03.8). The shoulder type needs to be concrete or bituminous.

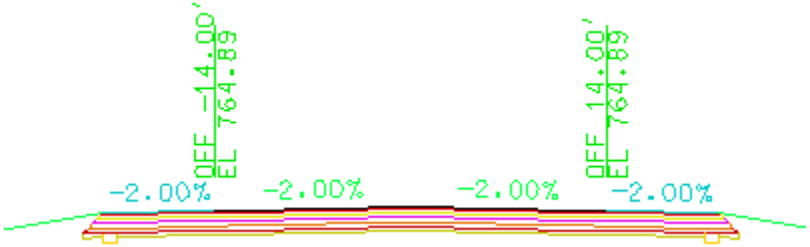
Both the outside and median shoulder slope is –2% on tangent, so the redefinable variables _d_NormalOutsideShoulderSlope and _d_NormalMedianShoulderSlope should both be set to –2.

The shoulder layer thickness values for _d_ShoulderLayer1Thick, _d_ShoulderLayer2Thick, _d_ShoulderLayer3Thick, and _d_ShoulderLayer4Thick should match the values for the corresponding pavement layer thickness. This allows for a continuation of the pavement layers between the pavement and shoulder since the cross sections do not indicate the location of any joints. It is also required to have the aggregate base under the pavement extend under the shoulder as well.

Examples



Concrete (Rigid) Pavement and Shoulder
EOS Offset and Elevation Shown



Bituminous (Flexible) Pavement and Shoulder
EOS Offset and Elevation Not Shown

Type A2 Shoulders (Partial Pavement Depth Bituminous Shoulders)

Type A2 shoulder is used on the outside of light duty pavements with ADT greater than 3500 (PDM Figures 6-03.3 thru 6-03.5). The shoulder type must be bituminous to have the correct shoulder closure.

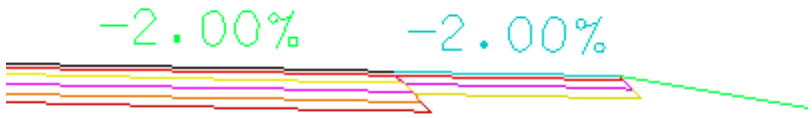
Since all paved shoulders have a –2% cross slope, _d_NormalOutsideShoulderSlope should both be set to –2.

To show each of the bituminous layers, _d_ShoulderLayer1Thick and _d_ShoulderLayer2Thick should be set to 1.75/12 and 4/12, respectively.

The shoulder aggregate layer obtains its thickness from _d_ShoulderLayer3Thick. If the pavement has a rock base, it should be set to the total pavement thickness in master units minus 5.75/12 so that the shoulder aggregate extends down to the rock base. When a rock base is not present, _d_ShoulderLayer3Thick is 4/12. For this shoulder type _d_ShoulderLayer4Thick should always be zero (0).

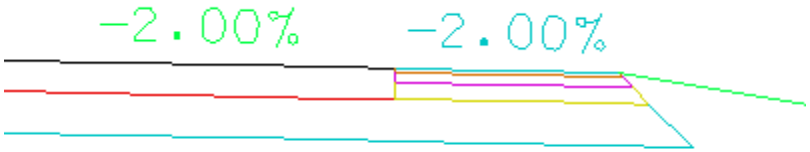
Example 1 Pavement and Shoulder Without Rock Base

Concrete (Rigid) Pavement and Type A2 Shoulder

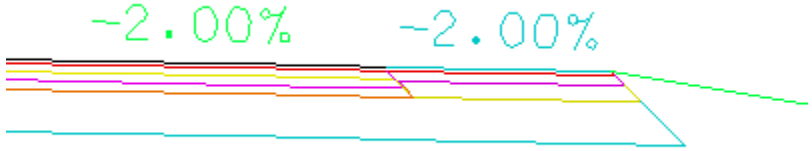


Bituminous (Flexible) Pavement and Type A2 Shoulder

Example 2 Pavement and Shoulder on Rock Base



Concrete (Rigid) Pavement and Type A2 Shoulder



Bituminous (Flexible) Pavement and Type A2 Shoulder

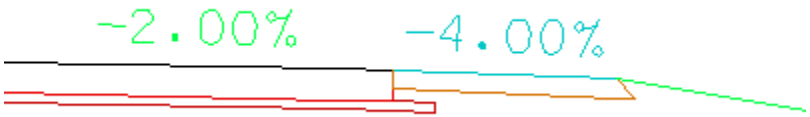
Type B Shoulders (8” Aggregate Shoulders)

Type B shoulder is for light duty pavement & ADT of 1700-3500 (PDM Figure 6-03.2). The shoulder type must be aggregate and _s_ExtensionSlope should be set to ^S^ shoulder slope.

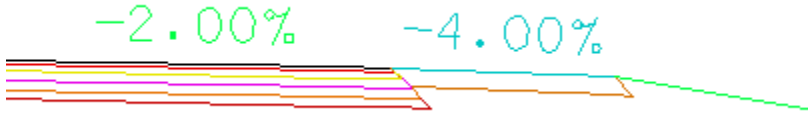
Since all non-paved shoulders have a –4% cross slope, _d_NormalOutsideShoulderSlope should both be set to –4.

Since the aggregate is 8” thick, _d_ShoulderLayer1Thick should be 8/12. The redefinable variable values for the rest of the layers are ignored (_d_ShoulderLayer2Thick, _d_ShoulderLayer3Thick, & _d_ShoulderLayer4Thick).

Example



Concrete (Rigid) Pavement and Type B Shoulder



Bituminous (Flexible) Pavement and Type B Shoulder

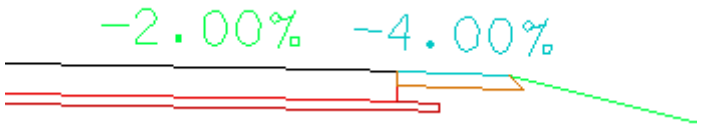
Type C Shoulders (6” Aggregate Shoulders)

Type C shoulder is for light duty pavement & ADT of 750-1700 (PDM Figure 6-03.1). The shoulder type must be aggregate and _s_ExtensionSlope should be set to ^S^ shoulder slope.

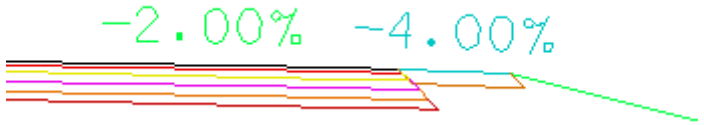
Since all non-paved shoulders have a –4% cross slope, _d_NormalOutsideShoulderSlope should both be set to –4.

Since the aggregate is 6” thick, _d_ShoulderLayer1Thick should be 6/12. The redefinable variable values for the rest of the layers are ignored (_d_ShoulderLayer2Thick, _d_ShoulderLayer3Thick, & _d_ShoulderLayer4Thick).

Example



Concrete (Rigid) Pavement and Type C Shoulder



Bituminous (Flexible) Pavement and Type C Shoulder

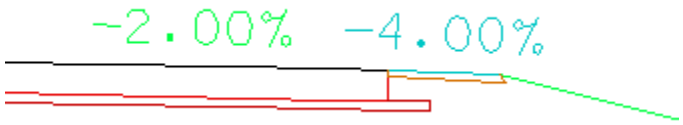
Type D Shoulders (3” Minimum Aggregate Shoulders)

Type D shoulder is for light duty pavement & ADT of 400-750 (PDM Figure 6-03.1). The shoulder type must be aggregate and _s_ExtensionSlope should be set to ^P^ Pavement slope.

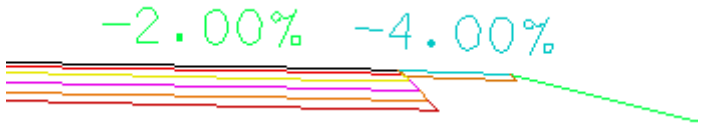
Since all non-paved shoulders have a –4% cross slope, _d_NormalOutsideShoulderSlope should both be set to –4.

Since the minimum aggregate thickness is 3”, _d_ShoulderLayer1Thick should be set to a minimum of 3/12. The redefinable variable values for the rest of the layers are ignored (_d_ShoulderLayer2Thick, _d_ShoulderLayer3Thick, & _d_ShoulderLayer4Thick).

Example



Concrete (Rigid) Pavement and Type D Shoulder



Bituminous (Flexible) Pavement and Type D Shoulder

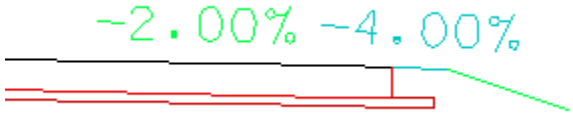
Type E Shoulders (Earth Shoulders)

Type E shoulder is for light duty pavement & ADT < 400 (PDM Figure 6-03.1) and _s_ExtensionSlope should be set to ^P^ Pavement slope.

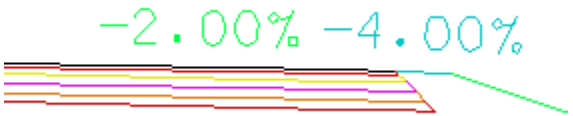
Since all non-paved shoulders have a –4% cross slope, _d_NormalOutsideShoulderSlope should both be set to –4.

The shoulder type should be set to earth so that the layer redefinable variables _d_ShoulderLayer1Thick, _d_ShoulderLayer2Thick, _d_ShoulderLayer3Thick, & _d_ShoulderLayer4Thick are ignored.

Example



Concrete (Rigid) Pavement and Type E Shoulder



Bituminous (Flexible) Pavement and Type E Shoulder

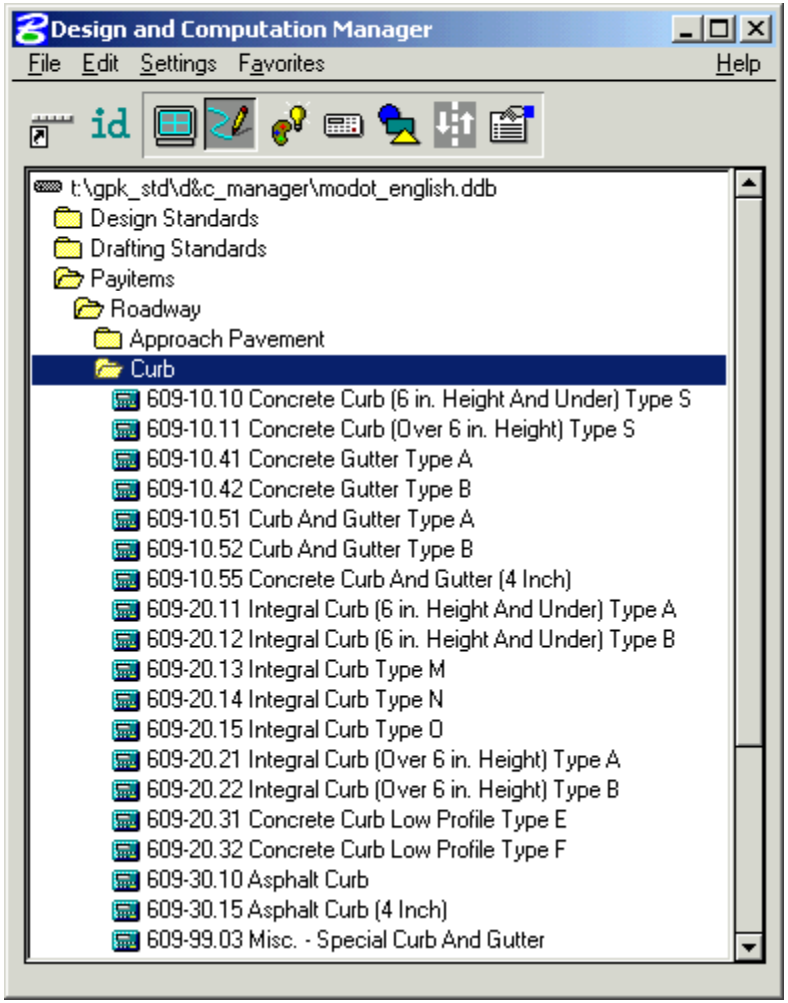
Appendix 8 Curbing With Urban Shoulders (U1 & U2)

Drawn by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

Plan View Geometry

Curbing

The type of curb drawn in a proposed cross section is determined by an element in the defined Proposed Plan DGN. This line must have the attribute matching the pay item for the desired type of curb, which is obtained from the **Design and Computation Manager** item in the **Payitems/Roadway/Curb** folder shown in the figure to the right. The line must be located within a specified curb search distance from the proposed edge of paved surface. For curb and gutter (Types A & B) this may be the edge of pavement or the edge of shoulder. For all other curb types, the edge of paved surface must be a shoulder.



The specified curb search distance is obtained from the redefinable variable: _d_CurbSearchDistance, which must be a positive number in master units.

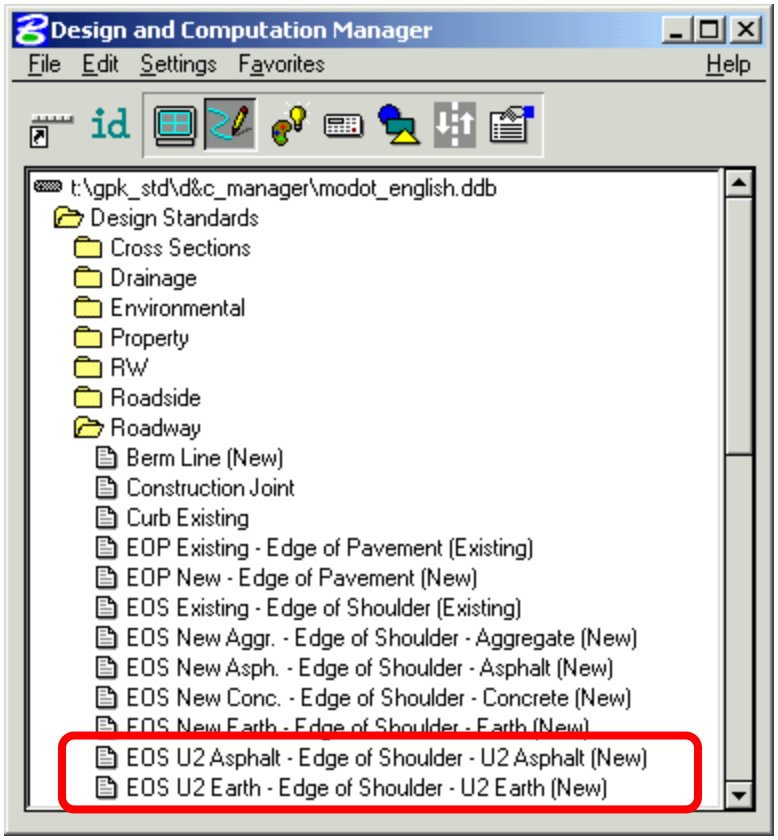
The location of the curb in the proposed cross section is determined by the proposed edge of paved surface in the Proposed Plan DGN. This line indicates the start of the gutter section for a curb & gutter (Type A, B, or Misc. - Special) or the gutter line for an integral (Type A, B, F, M, N, or O) or a separated curb (Type F or S). Consequently, the curb line shown in the Proposed Plan DGN can be drawn at either the front or the back of the curb without affecting the location of the curb in the proposed cross section.

U1 Shoulder

U1 shoulders use the same parameters as Type A, A1, or A2 shoulders. As with rural shoulders, the width and type is obtained either from a plan view element or from the redefinable variables. See Appendix 7 Rural Shoulders for further details.

U2 Shoulder

The presence of a U2 shoulder behind the curb can be indicated in two ways: either by placing an edge of U2 shoulder line in the Proposed Plan DGN or by defining a U2 shoulder width using a redefinable variable.

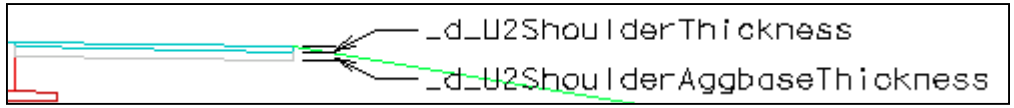


To draw U2 shoulder lines in the designated Proposed Plan DGN, use the **Design and Computation Manager** items EOS U2 Asphalt or EOS U2 Earth. These items (outlined in the figure to there right) are in the **Design Standards/Roadway** folder. For the line to be recognized by the criteria, it must be located within the search distance (master units) specified by the redefinable variable _d_U2ShoulderSearchDistance, as measured from the back of the curb.

If a U2 edge of shoulder line is not found within the applicable search distance, the criteria uses _d_U2ShoulderWidth to determine the width of the U2 shoulder in master units from the back of the curb. If a U2 shoulder is not needed, do not have a U2 shoulder line within the search distance in the Proposed Plan DGN and set _d_U2ShoulderWidth to zero. The plan element **ALWAYS** "overrides" this variable.

The slope of the U2 Shoulder is controlled by _d_U2ShoulderSlope.

If an EOS U2 Asphalt line or _d_U2ShoulderWidth is used to specify the width of the U2 shoulder, subsurface shoulder lines may be drawn in the proposed cross section by specifying the appropriate thicknesses (in master units) for the Redefinable Variables _d_U2ShoulderThickness (for the asphalt thickness) and _d_U2ShoulderAggbaseThickness (for the aggregate base thickness). If an EOS U2 Earth line is used to indicate the presence of a U2 shoulder, the values of the two thickness variables are ignored and only the surface line is drawn.



The only type of curb that can be drawn behind the U2 shoulder is Type S (Separated) curb. If this type of curb is desired, include a line in the Proposed Plan DGN using the appropriate D&C curb pay item on the outside of the U2 shoulder within the search distance defined by _d_CurbSearchDistance, which must be less than the width of the U2 shoulder and is measured from the outer edge of the U2 shoulder. The face of the curb will be drawn at the outer edge of the U2 shoulder in the proposed cross section.

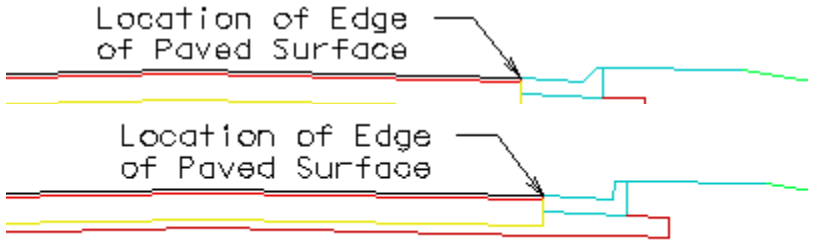
Curbing Cross-Section Details

Curb & Gutter

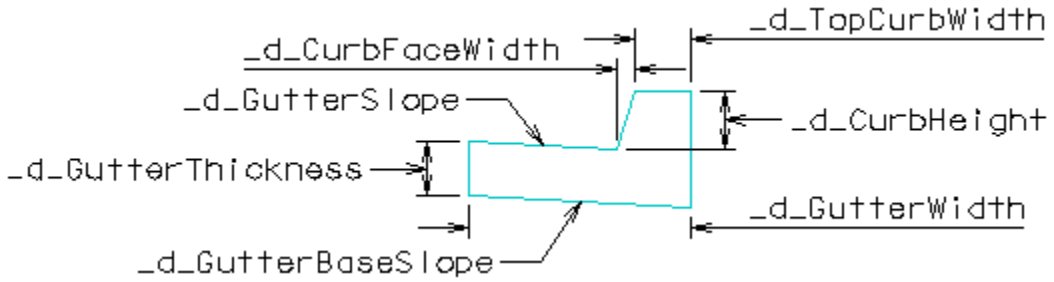
Curb & gutter can be placed adjacent to any paved surface (pavement or shoulder), which can be either concrete or asphalt. If the curb & gutter is placed next to a shoulder, the shoulder thicknesses must match the pavement thickness for the pavement base aggregate to extend under the curb & gutter. The outer edge of paved surface locates the inner face of the gutter in the proposed cross section.

Type A (Mountable) Curb & Gutter
In the Proposed Plan DGN, the line for Curb & Gutter Type A needs to have the attribute of pay item 609-10.51.

Type B (Barrier) Curb & Gutter
In the Proposed Plan DGN, the line for Curb & Gutter Type B Type B Curb and Gutter needs to have the attribute of pay item 609-10.52.



User Defined Curb & Gutter
The user can define a special curb and gutter by placing a line in the Proposed Plan DGN having the attribute of pay item 609-99.03. If this line is within the search distance the criteria draws a non-standard curb and gutter using the redefinable variables shown in the figure to the right. The values for _d_GutterSlope and _d_GutterBaseSlope are in percent (%) and all other values are in master units.



Warning for Curb & Gutter
If the bottom of the pavement is not below the bottom of the curb and gutter, the criteria will not extend the aggregate under the curb and gutter. Instead, the aggregate layers will stop at the face of the gutter and the following note will be plotted in the cross-section: Warning, AggBase1 Depth Not Able to Extend Under Curb! It is assumed that the pavement structure will be at least as thick and the gutter.

Gutter Slope on High Side of Super Elevation
Using the normal slope for curb and gutter on the high side of super elevation will result in the gutter holding water. If this is not desirable, set the redefinable variable _s_GutterSlopeInSuper to ^U^ for the gutter slope to be up on the side of super elevation. If it is permissible for it to hold water set the variable to ^D^ for the gutter slope to be down.

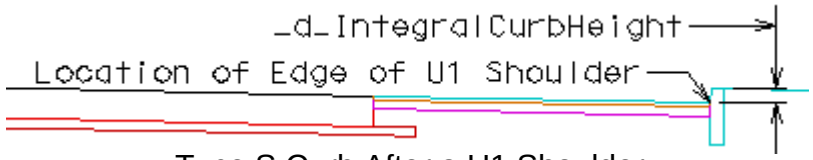
Separated Curb

In the Proposed Plan DGN, the curb line with the appropriate pay item attribute can be anywhere within the curb search distance from the edge of a shoulder, which indicates where the gutter line will be drawn in the Proposed Cross-Section DGN.

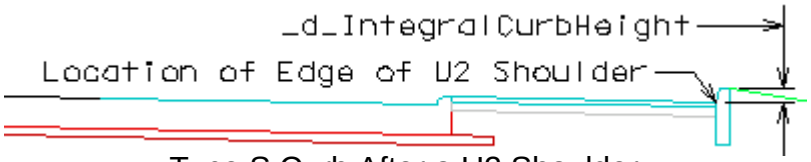
Note: Even though the Standards Plans allow for the height of the curb below the paved surface to be less than the default value if the curb is keyed into rock, the default value is always used.

Type S Separated Barrier Curb

In the Proposed Plan DGN, the line for Type S Curb needs to have the attribute of pay item 609-10.10 Concrete Curb Type S 6 Inch And Under or 609-10.11 Concrete Curb Type S Over 6 Inch, which can be placed after either a U1 **or** a U2 shoulder. If the criteria file finds a curb line having either pay item within the search distance, it will draw a Type S (Separated) Curb using the value of the Redefinable Variable _d_IntegralCurbHeight to specify the curb height in master units.



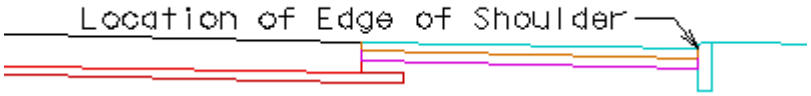
Type S Curb After a U1 Shoulder



Type S Curb After a U2 Shoulder

Type F (Separated) Low Profile Curb

In the Proposed Plan DGN, the line for the Type F Curb needs to have the attribute of pay item 609-20.32 Low Profile Curb Type F.



Type F (Separated) Low Profile Curb

Gutter Details

Gutter may be drawn after a shoulder or a retaining wall in cut. The outer edge of the shoulder or the back of the retaining wall locates the start of the gutter. If a gutter line with the appropriate pay item attribute is found anywhere within the curb search distance in the Proposed Plan DGN, gutter will be drawn in the Proposed Cross-Section DGN.

Type A Gutter

In the Proposed Plan DGN, the line for the Gutter Type A needs to have the attribute of pay item 609-10.41.

Type A Gutter

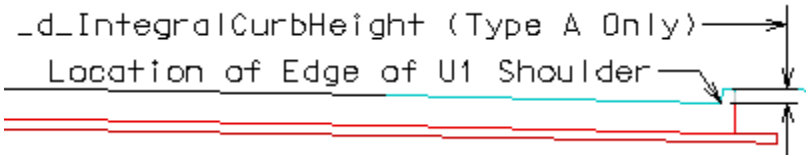
Type B Gutter

In the Proposed Plan DGN, the line for the Gutter Type B needs to have the attribute of pay item 609-10.42.

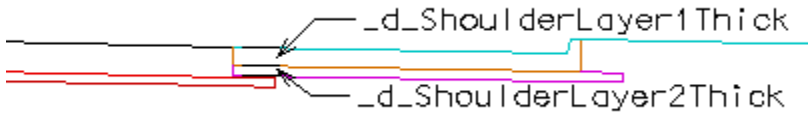
Type B Gutter

Integral Curb Types A, M, O, and E

In the Proposed Plan DGN, the curb line with the appropriate pay item attribute can be anywhere within the curb search distance from the edge of shoulder, which indicates where the gutter line will be drawn in the Proposed Cross-Section DGN. To be drawn correctly, all types of integral curb require a concrete U1 shoulder to be defined. The thickness of the U1 shoulder is controlled by the redefinable variable _d_ShoulderLayer1Thick. If its value matches _d_PavementLayer1Thick, the aggregate under the pavement will extend under both the shoulder and the curb. If the thickness of the U1 shoulder is different from the pavement, aggregate base(s) can be drawn under the shoulder and curb by specifying a value greater than zero (0) for the thickness of the appropriate shoulder layer(s) using the redefinable variables _d_ShoulderLayer2Thick, _d_ShoulderLayer3Thick, and _d_ShoulderLayer4Thick.



U1 Shoulder Thickness Equals Pavement Thickness



U1 Shoulder Thickness Less Than Pavement Thickness

Type A Integral Barrier Curb

In the Proposed Plan DGN, the line for the Type A Integral Curb needs to have the attribute of pay item 609-20.11 Integral Curb Type A 6 Inch And Under or 609-20.21 Integral Curb Type A Over 6 Inch. If the criteria file finds a curb line having either pay item within the search distance, it will draw a Type A Integral Curb using the value of the Redefinable Variable _d_IntegralCurbHeight to specify the curb height in master units.

Type E (Integral) Low Profile Curb

In the Proposed Plan DGN, the line for the Type E Integral Low Profile Curb needs to have the attribute of pay item 609-20.31 Low Profile Curb Type E.

Type M (Integral) Mountable Curb

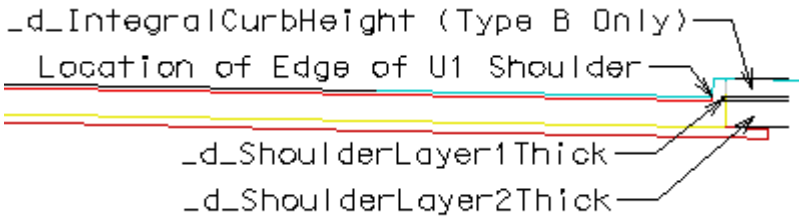
In the Proposed Plan DGN, the line for the Type M Integral Curb needs to have the attribute of pay item 609-20.13 Integral Curb Type M.

Type O (Integral) Mountable Curb

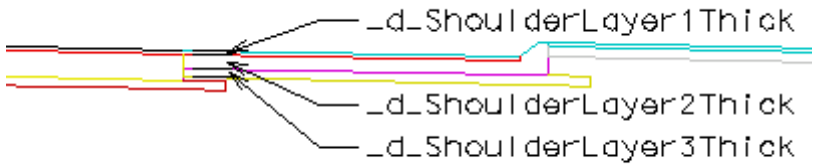
In the Proposed Plan DGN, the line for the Type O Integral Mountable Curb needs to have the attribute of pay item 609-20.15 Integral Curb Type O.

Integral Curb Types B and N

In the Proposed Plan DGN, the curb line with the appropriate pay item attribute can be anywhere within the curb search distance from the edge of shoulder, which indicates where the gutter line will be drawn in the Proposed Cross-Section DGN. To be drawn correctly, all types of integral curb require a concrete U1 shoulder to be defined. The total thickness of the U1 shoulder is the algebraic sum of the redefinable variables _d_ShoulderLayer1Thick and _d_ShoulderLayer2Thick, where the first variable controls the thickness of the overlay and the second controls the thickness of the concrete portion of the shoulder. For the aggregate base under the pavement to extend under the U1 shoulder and the curb, the thicknesses of the pavement and corresponding shoulder layers must be the same (_d_PavementLayer1Thick equals _d_ShoulderLayer1Thick and _d_PavementLayer2Thick equals _d_ShoulderLayer2Thick for that station). If the respective pavement and shoulder layers have different thicknesses, aggregate base(s) can be drawn under the shoulder and curb by specifying a value greater than zero (0) for the thickness of the appropriate shoulder layer(s) using the redefinable variables _d_ShoulderLayer3Thick, and _d_ShoulderLayer4Thick.



U1 Shoulder Thicknesses Equal Pavement Thicknesses



U1 Shoulder Thicknesses Do Not Equal Pavement Thicknesses

Type B Integral Barrier Curb

In the Proposed Plan DGN, the line for the Type B Integral Curb needs to have the attribute of pay item 609-20.12 Integral Curb Type B 6 Inch And Under or 609-20.22 Integral Curb Type B Over 6 Inch. If the criteria file finds a curb line having either pay item within the search distance, it draws a Type B Integral Curb using the value of the Redefinable Variable _d_IntegralCurbHeight to specify the curb height in master units.

Type N (Integral) Mountable Curb

In the Proposed Plan DGN, the line for the Type N Integral Curb needs to have the attribute of pay item 609-20.14 Integral Curb Type N.

Appendix 9 Standard Side Slopes

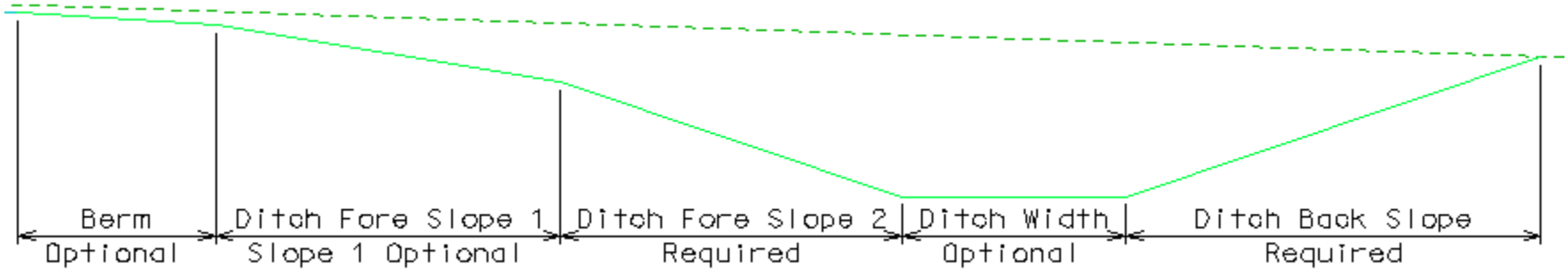
All pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon) draw standard side slopes, which are **drawn without special profiles**.

Standard Side Slope Closure Options

The side slope can close to existing ground using a standard section in cut and fill or a special forced closure section. These options are briefly described on the rest of this page with further details provided in the rest of this appendix. The typical section may also include other items, such as Special Ditches, Sidewalk located in a Berm, varying side slope values using a Tapering Procedure, Rock Benches, Retaining Walls, Gore Areas, a Levee and Optional Interception Ditch. These options are described in other appendices. To stop a side slope at a match line, see Appendix 12 Match Lines.

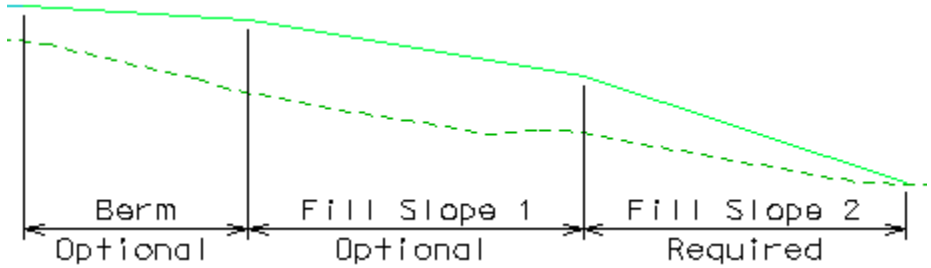
Standard Cut Slope Options

A ditch fore slope and back slope are required if a standard cut section is used, which are labeled as Ditch Fore Slope 2 and Ditch Back Slope in the following figure. In addition the user can include a berm, an additional ditch fore slope, and a ditch width.



Standard Fill Slope Options

A single fore slope is required if a standard fill section is used, which is labeled as Fill Slope 1 in the figure to the right. In addition the user can include a berm and an additional fore slope.



Standard Forced Closure Slope Option

The user can force the side slope to close directly to existing ground from the edge of shoulder or back of curb by using this option.

Side Slope Details

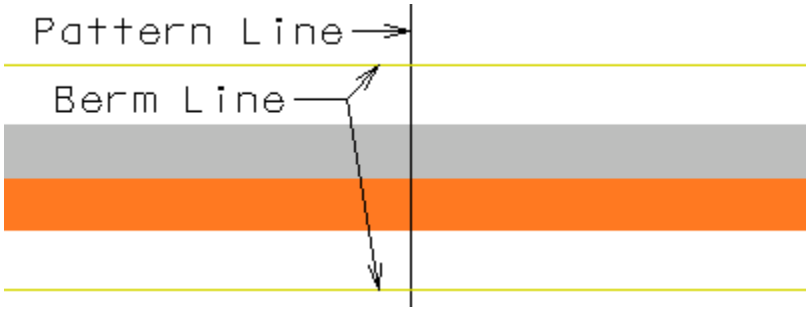
Berm

Drawn by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon). The optional berm is intended to be used for non-paved guardrail widening, grass areas for locating Sidewalk, and other cases that require a slope defined by percent at the start of the side slope. It may be used in cut or fill and is drawn as part of the Standard Side Slopes.

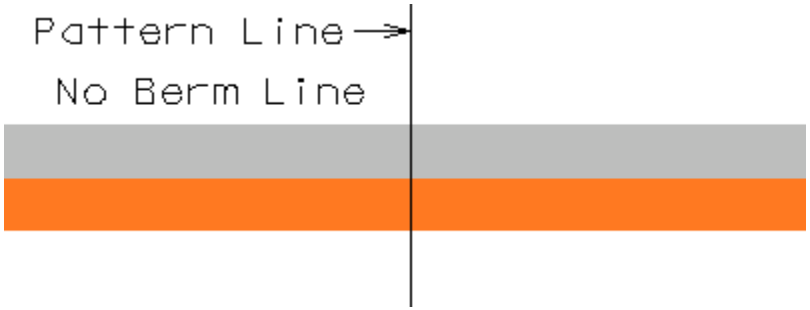
Berm Width
The width of the berm can be specified in two ways. It can be determined either by a berm line in the GEOPAK Lines DGN or by a redefinable variable.

Berm lines may be drawn in the designated GEOPAK Lines DGN. To draw the lines use the **D&C Manager** item Berm Line, which is located in the D&C Manager path: "**Design Standards/Roadway/**".

If a berm line is not present, the redefinable variables _d_BermWidth_Left and _d_BermWidth_Right are used to determine the width of the berm in master units on the left and right side, respectively. A plan element **ALWAYS** "overrides" these variables.



GEOPAK Lines DGN with a Berm Line
DGN Element Controls Berm Width



GEOPAK Lines DGN without a Berm Line
Redefinable Variable Controls Berm Width

If a berm is not desired at a particular location, do not have a berm line crossing the pattern line on that side of the roadway and set the berm width redefinable variable for that location to zero.

Berm Slope
The berm slope on each side of the roadway is controlled by the redefinable variables _d_BermSlope_Left and _d_BermSlope_Right (in percent without the percent sign). Include the negative sign when applicable.

Ditch Fore Slope 1 (Optional)

The ditch fore slope 1 option is provided if a change in the run:rise defined slope is required before the ditch.

The width of the ditch fore slope 1 can be specified in two ways. It can be determined either by a cut slope 1 break line in the GEOPAK Lines DGN or by a redefinable variable.

A Cut Slope 1 Break Line may be drawn in the designated GEOPAK Lines DGN. To draw the line use the **D&C Manager** item **Slope Cut**, which is located in the D&C Manager path: "**Design Standards/Drainage/**".

If a slope cut line is not present, the redefinable variables _d_DitchForeSlope1Width_Left and _d_DitchForeSlope1Width_Right are used to determine the width of the ditch fore slope 1 in master units on the left and right side, respectively. A plan element **ALWAYS** "overrides" these variables.

If a ditch fore slope 1 is not desired at a particular location, do not have a slope cut line crossing the pattern, set the ditch fore slope 1 width redefinable variable to zero, or make ditch fore slope 1 the same as ditch fore slope 2.

The ratio of ditch fore slope 1 is controlled by the redefinable variables _d_DitchForeSlope1_Left and _d_DitchForeSlope1_Right in Run:Rise format. Rise is ALWAYS a negative number. Example, 4:-1. Make sure to include the colon.

Ditch Fore Slope 2 (Required)

The ratio of ditch fore slope 2 is controlled by the redefinable variables _d_DitchForeSlope2_Left and _d_DitchForeSlope2_Right in Run:Rise format. Rise is ALWAYS a negative number. Example, 4:-1. Make sure to include the colon. This slope will be continued from its start to the bottom of the ditch.

Standard Ditch Depth

The depth a standard ditch is controlled by _d_StandardDitchDepth_Left and _d_StandardDitchDepth_Right, which is measured from the start of the ditch fore slope in master units. This is a positive value and MUST be greater than zero.

Ditch Width

The width of the ditch is controlled by the redefinable variables _d_DitchWidth_Left and _d_DitchWidth_Right in master units. Set the value of the variable to zero for a "V" ditch or greater than zero for a flat bottom ditch.

Ditch Back Slope (Required)

The ratio of ditch back slope is controlled by the redefinable variables _d_DitchBackSlope_Left and _d_DitchBackSlope_Right in Run:Rise format. Rise is ALWAYS a positive number. Example, 3:1. Make sure to include the colon. This slope continues from bottom of the ditch to existing ground for standard ditches unless Right of Way constraints are used, which are described on the next page.

Fill Slope 1 (Optional)

The fill slope 1 option is provided if a change in the run:rise defined slope is required in fill.

The width of fill slope 1 can be specified in two ways. It can be determined either by a fill slope 1 break line in the GEOPAK Lines DGN or by a redefinable variable.

A Fill Slope 1 Break Line may be drawn in the designated GEOPAK Lines DGN. To draw the line use the **D&C Manager** item **Slope Fill**, which is located in the D&C Manager path: "**Design Standards/Drainage/**".

If a slope fill line is not present, the redefinable variables _d_FillSlope1Width_Left and _d_FillSlope1Width_Right are used to determine the width of the fill slope 1 in master units on the left and right side, respectively. A plan element **ALWAYS** "overrides" these variables.

If fill slope 1 is not desired at a particular location, do not have a slope fill line crossing the pattern, set the fill slope 1 width redefinable variable to zero, or make the slope fill slope 1 the same as fill slope 2.

The ratio of fill slope 1 is controlled by the redefinable variables _d_FillSlope1_Left and _d_FillSlope1_Right in Run:Rise format. Rise is ALWAYS a negative number. Example, 4:-1. Make sure to include the colon.

Fill Slope 2 (Required)

The ratio of fill slope 2 is controlled by the redefinable variables _d_FillSlope2_Left and _d_FillSlope2_Right in Run:Rise format. Rise is ALWAYS a negative number. Example, 4:-1. Make sure to include the colon. This slope continues from its start to the intersection with existing ground unless Right of Way constraints are used.

Draw Ditches In Plan View Details

The ditches and the flow arrows can be drawn in the plan view while processing the proposed cross-sections. The redefinable variable _s_DrawDitchesInPlanView controls this behavior. The globally defined variables Plan View Scale and Plan View Flow Arrow Scale control the size of the text displaying the average ditch slope between cross sections and the size of the flow arrows, respectively. Set the scale to match the plan sheet plot scale. For a scale of 1"=50' enter the number 50 as a value. If you do not wish to see either the average ditch slope or flow arrows, set the value of its respective scale to a very small number, such as 0.001.

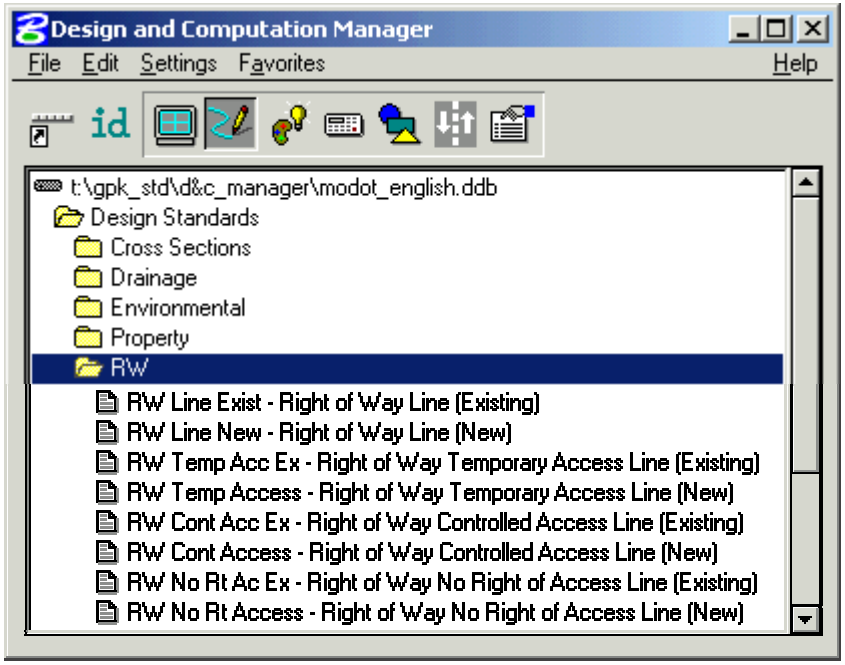
Right of Way Constrained Tie Slopes

Tie slopes can be forced to stay within the right of way. This behavior is controlled by both plan view elements drawn in the defined Right of Way DGN and redefinable variables.

Right of Way DGN Geometry

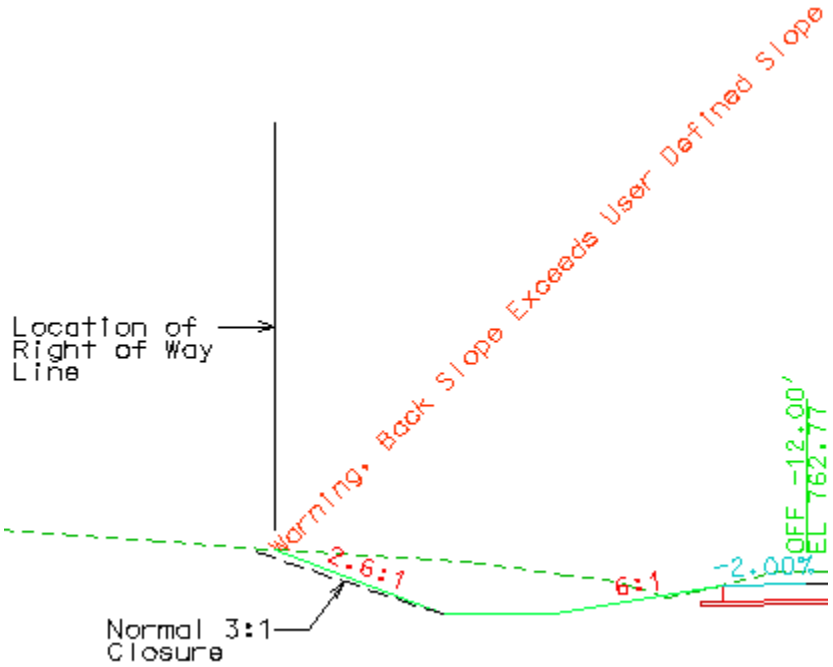
For right of way constrained tie slopes to work, a right of way line must be drawn in the defined Right of Way DGN using one of the eight items in the D&C Manager path: "**Design Standards/RW/**" shown below:

RW Line Exist. – Right of Way Line (Existing)
RW Line New – Right of Way Line (New)
RW Temp Acc Ex – Right of Way Access Line (Existing)
RW Temp Access – Right of Way Access Line (New)
RW Cont Acc Ex – Right of Way Controlled Access Line (Existing)
RW Cont Access – Right of Way Controlled Access Line (New)
RW No Rt Ac Ex – Right of Way No Right of Access Line (Existing)
RW No Rt Access – Right of Way No Right of Access Line (New)

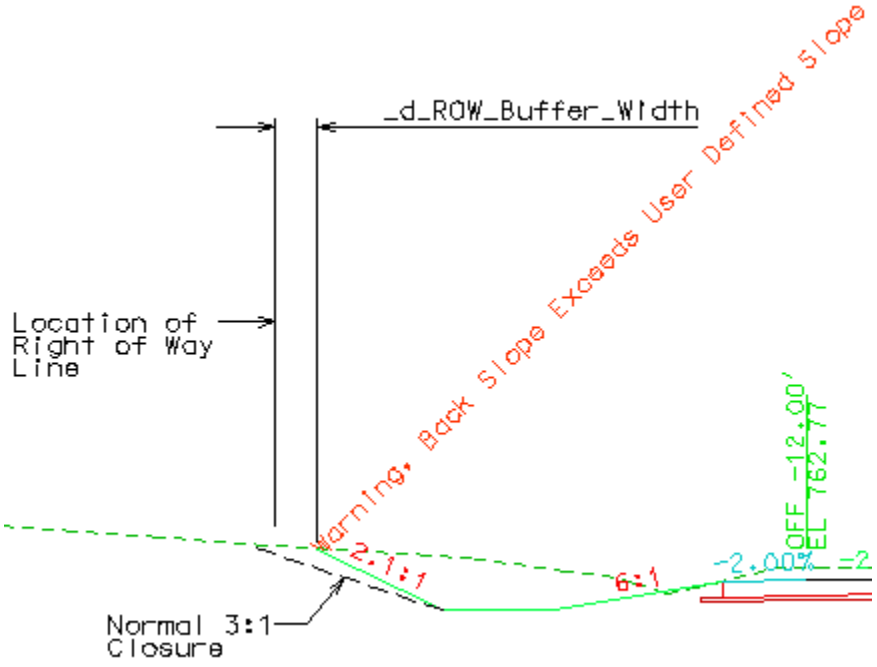


Right of Way Constrained Slopes Cross-Section Details

Three redefinable variables are also used to determine how tie slopes are constrained by the right of way lines discussed above. The variables, _s_LeftROWConstrainedSlope and _s_RightROWConstrainedSlope control whether or not the constraint is to be applied to the left and right sides respectively. To constrain the slope set the variable for that side to ^Yes^. If normal closure is desired, set the variable to ^No^. The carets "^" are required. An additional buffer can be applied that will force the tie to be within the right of way point by the buffer width set using the variable _d_ROW_Buffer_Width in master units. If the constraint is applied and the normal slope can fit within the right of way then the normal slope will be used. If the normal slope will not fit within right of way, then a steeper slope will be drawn and labeled as such. This will allow the user to identify when their slopes drawn were steeper than the defaults, as shown in the following two figures.



Right of Way Constrained Slope
With Buffer Width Set to Zero



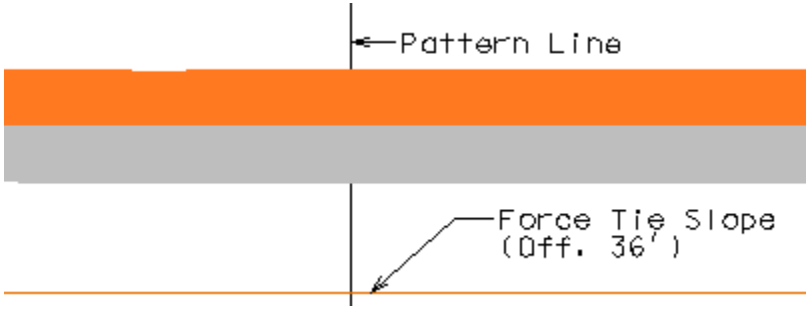
Right of Way Constrained Slope
With Buffer Width Set to 3’

Forced Closure Slopes

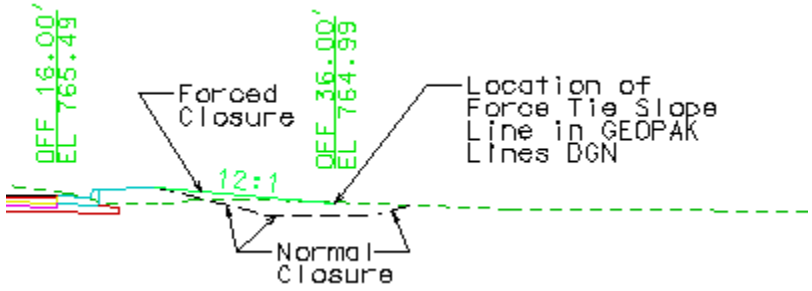
Whether or not the side slope closes directly to existing ground from the edge of shoulder or back of curb can be controlled in two ways. It can be controlled either by a **Force Tie Slope** line in the GEOPAK Lines DGN or by a redefinable variable.

Forced Closure using GEOPAK Lines DGN Element

Force Tie Slope lines may be drawn in the designated GEOPAK Lines DGN. To draw the lines use the **D&C Manager** item **Force Tie Slope**, which is located in the D&C Manager path: "**Design Standards/Roadway/**". If this line crosses the pattern line for a specific side slope, a single side slope line will be drawn from the edge of shoulder or back of curb to the location where the force tie slope line intersects the existing ground.



GEOPAK Lines DGN with Force Tie Slope Line



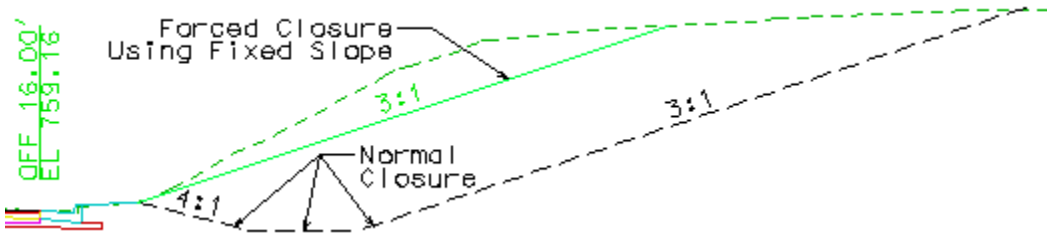
Cross-Section View Showing Force Closure Effect

Forced Closure using Redefinable Variables

If a force tie slope line is not used, _s_LeftForceClosingSlopes and _s_RightForceClosingSlopes can be use instead. To force the sloped closed set the variable for that side to ^Yes^. If normal closure is desired, set the variable to ^No^. The carets "^" are required.

The closure slope is controlled by redefinable variables using the Run:Rise format with the colon required. If the section is in cut Rise is ALWAYS positive and the variables _d_LeftForcedCutSlope and _d_RightForcedCutSlope control the slope for each side. If the section is in fill, Rise is ALWAYS a negative number (Example, 2:-1) and the closure slope for each side is controlled by _d_LeftForcedFillSlope and _d_RightForcedFillSlope.

The plan element will **ALWAYS** "override" these variables.



Cross-Section View Showing Force Closure Effect

Appendix 10 Special Ditches

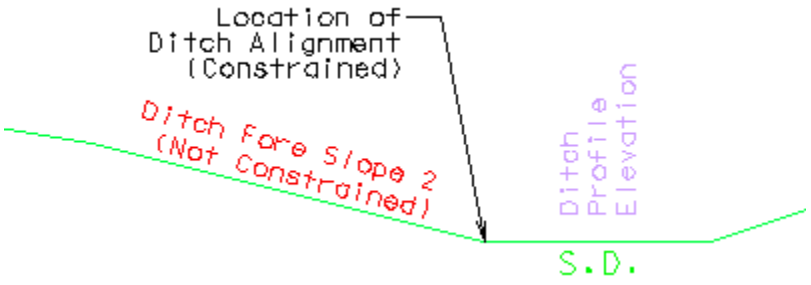
All pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon) draw special ditches, which are **drawn using profiles to set the ditch elevation**. These are used instead of the standard ditches drawn by the Standard Side Slopes.

Special Ditch Options

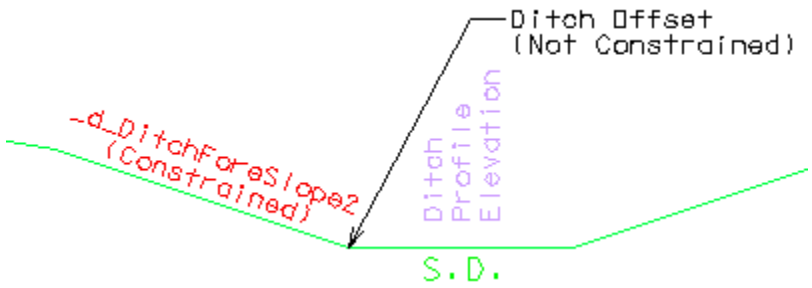
Special ditches allow the user to control the elevation of a ditch at any cross-section by defining a special ditch profile. Different profiles may be used for the left and right side. For the side slope to tie into a special ditch, either the offset to the ditch or the final ditch fore slope must be unconstrained. Note: The use of a special ditch profile **ALWAYS** "overrides" the standard ditch depth redefinable variables _d_StandardDitchDepth_Left and _d_StandardDitchDepth_Right.

If a ditch alignment is defined for the side slope condition, the offset to the ditch is fixed with the inside edge of the ditch starting at the ditch alignment and ditch fore slope 2 is unconstrained, consequently the redefinable variable for that side (_d_DitchForeSlope2_Left or _d_DitchForeSlope2_Right) is ignored. This condition is illustrated in the figure below and on the left.

If a ditch alignment is not defined for the side slope condition, ditch fore slope 2 for that side is fixed by _d_DitchForeSlope2_Left or _d_DitchForeSlope2_Right and the offset is unconstrained. This condition is illustrated in the figure below and on the right.



Special Ditch Location Constrained by Ditch Alignment
Fore Slope Before Special Ditch Is Unconstrained



Fore Slope Before Special Ditch Is Constrained
Offset to Special Ditch is Unconstrained

The above figures show the special ditches labeled “S.D.” This lets the user know that a special ditch has been drawn of the this side slope condition. The user can specify this label using the redefinable variable _s_SpecialDitchLabel, Example: ^S.D.^. The carets “^” are required.

Special Ditch Profile and Alignment Variables

The variables for the special ditch COGO elements are in the **Define Variables** section of a proposed cross-section run. The elements must be stored in COGO before processing the cross section run. The station range for both the profiles and the ditch alignments must include the cross-section station for them to be used by the criteria. These and other features are discussed in more detail below.

Special Ditch Profiles

For a special ditch profile to be used it must be listed under the appropriate define variable and must exist for the cross-section station. Separate profiles may be created for the left and right side slope conditions and must be listed in the value for the variable Left Special Ditch Profiles and Right Special Ditch Profiles respectively. Commas must separate the profile names. Examples: ltdit1,ltdit2,ltdit3 or rtdit1,rtdit2,rtdit3.

The criteria use the following logic to determine the elevation for the special ditch: If the cross-section station is included in the station range for one of the special ditch profiles, the criteria checks to see if a ditch alignment is encountered. If the ditch alignment is found, the station where the pattern line crosses the ditch alignment is noted and the elevation from the profile at **the ditch alignment station** is used to set the ditch elevation. If a ditch alignment is not defined, the elevation from the profile at **the cross-section station** is used to set the ditch elevation. In other words, the elevation from the profile at the ditch alignment station is used if there is a valid ditch alignment for the side slope condition; otherwise, the elevation at the cross-section station is used.

Ditch Alignments

For a ditch alignment to be used it must be listed under the appropriate define variable. Only one ditch alignment per side per cross-section run is allowed. The alignment for the left and right side slope condition must be listed in the value for the variable Left Ditch Alignment and Right Ditch Alignment respectively. Examples: ltditch or rtditch.

Because the cross-section station must be included in the special ditch profile station range, it is recommended that the mainline station where the ditch alignment begins be used as the ditch alignment beginning station. If this is done, the station for the ditch alignment will be similar to the station for the cross-section.

If a ditch alignment is used, the elevation from the profile at the ditch alignment station is used to set the ditch elevation and the inside edge of the ditch will be at the location of the ditch alignment. This is helpful when trying to match an existing culvert for example. This will vary the ditch fore slope 2 variable and force the ditch to have varying ditch fore slopes. In other words, if a ditch alignment is used, the ditch fore slope redefinable variable is ignored.

Go to: Match Line Cross-Section Details for Non-Controlling Roadway

Appendix 11 Medians

Used by divided pavement typical sections (DNPavt, DRecon, NLtRRt, & NRtRLt).

There are a total of seven types of medians. Types 1-4 are all rural grass medians with no thickness shown. Type 5 has a raised median, which is paved if the width of the median does not exceed the redefinable variable _d_MaxPavedMedianWidth. Type 6 is flush paved median with a Type A or C concrete barrier, which may be flat on the bottom or stepped. It requires one and only one new edge of shoulder line is to be drawn between the median edges of pavement. This single shoulder line represents the centerline location of the concrete barrier. The Type 7 median has a retaining wall in the median. It requires two new edge of shoulder lines to be drawn between the median edges of pavement. The distance between the edges of shoulders controls the width of the retaining wall less a "hard coded" buffer distance of 1 inch on each side of the wall. See Appendix 15 Retaining Walls for an explanation of the variables used to draw the wall.

The different types are:

- 1 = Fixed slope and fixed depth with a variable ditch bottom width.
- 2 = Fixed slope and fixed ditch width with a variable ditch depth.
- 3 = Fixed ditch depth and fixed ditch bottom width with variable slopes.
- 4 = "V" Ditch with fixed slopes and a variable depth.
- 5 = Crowned median between curbs with the sloped controlled by the positive value of _d_MedianSlope1. The optional variable _d_PavedMedianThickness may be set greater than zero to show a thickness for this median type assuming the width of the median does not exceed the variable named _d_MaxPavedMedianWidth.
- 6A or 6C = Stepped Median Barrier using type A or type C barrier respectively
- 7 or 7B = Retaining Wall median without barrier on top "7" or with Barrier on top "7B"

One or two slopes may be used for the proposed ground surface to a median ditch for grass medians. The variable _d_MedianSlope1 controls the first slope, which is optional, and _d_MedianSlope2 controls the second slope, which is required. The width of the optional first slope is controlled by the redefinable variable _d_MedianSlope1Width. For median types 1 and 3, _d_StdMedianDitchDepth controls the fixed ditch depth and _d_MedianDitchWidth controls the fixed ditch bottom width for median types 2 and 3.

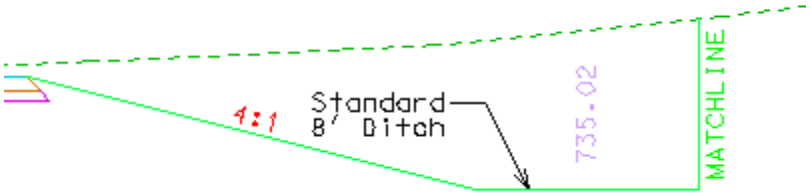
Appendix 12 Match Lines

Drawn by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

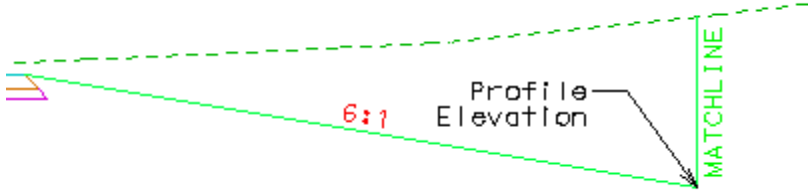
Match Line Options

Match lines allow the criteria to terminate a proposed ground side slope at a specific location and draw a vertical line from that location to existing ground, as shown in both of the figures below. This option is needed when the outside edge of a proposed side slope condition is adjacent to another proposed cross-section run, which occurs at interchanges and at any other situations where another proposed alignment runs along side the current run. Typically one of the alignments will control the elevation at the match line. The proposed cross-sections for the controlling alignment should be run first with a fixed final side slope. This is shown on the left below. Once the first set of cross sections is run, the Profile Grade Report may be used to create a profile and optional chain from these cross sections at the location of the match line. This profile and optional chain can be used to vary the slope of the proposed ground element by forcing it to end at the elevation obtained from the profile. This is shown on the right below.

There are two very different ways that the proposed ground surface can be modeled before the match line location is reached. Either a standard typical section can be used prior to the match line (as shown in the left figure below) or a straight line can be from the edge of shoulder, curb, or berm to a specific elevation at the location of the match line, which is the method shown in the right figure below.



Typical Section Before Match Line



Single Element Before Match Line

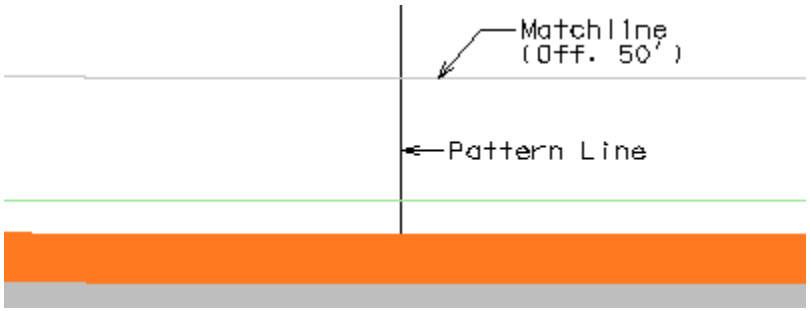
To draw a typical section prior to the match line (the case on the left above) a graphic element in the designated GEOPAK Lines DGN must be used to locate the match line. For this option, the redefinable variables described in the Appendix 9 Standard Side Slopes are used to draw the proposed ground elements prior to the match line. The final proposed ground element mat be drawn either at a fixed or a variable slope. The variable slope for the final element is used if a specific elevation is desired at the match line.

The easiest way to have a single proposed ground element before the match line is to use a match line chain to indicate the location of the match line and a match line profile to determine the elevation desired.

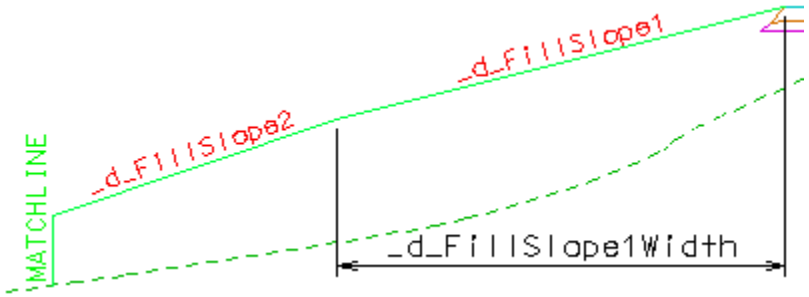
Each of these cases is treated separately below.

Typical Section Before Match Line Details

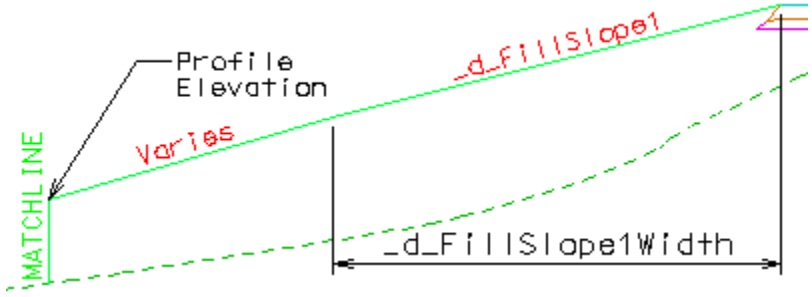
For any of the standard side slopes redefinable variables to be used by the criteria for this option, a graphic element is needed in the designated GEOPAK Lines DGN to indicate the location of the match line. This line must be drawn using the **D&C Manager** item **Matchline**, which is located in the D&C Manager path: "**Design Standards/Roadway/**". An example is shown in the figure to the right.



The slope on the final proposed ground element before the match line may be either a fixed value (as shown below in the figure on the left) or it can be variable with the element ending at an elevation obtained from a profile (as shown below in the figure on the right). To use a fixed slope for the final element, do NOT define a match line profile for that cross-section. If a match line profile is defined for the cross-section station, the final proposed ground element is drawn to the profile elevation. The match line profiles are defined for each side by using the Define Variables Left Match Line Profiles and Right Match Line Profiles. Commas must separate the profile names. Example: "ml1lt,ml2lt,ml3lt"; or "ml1rt,ml2rt,ml3rt". **Note:** The stationing of the profile must match the cross-section stationing.



Fixed Slope Option Used for Vertex at the Match Line
A Match Line Profile Is NOT Defined for the XS Station



Profile Used for Vertex at the Match Line
A Mach Line Profile Is Defined for the XS Station

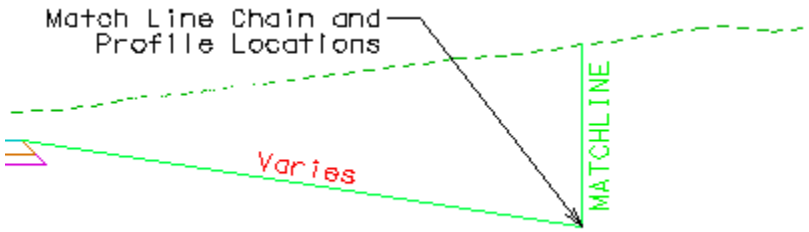
While the above examples are in fill, the same process works in cut. The only difference is the redefinable variables used.

Match Line Chain and Profile Details

If a single proposed ground element is to be drawn from the edge of shoulder, curb, or berm to a specified elevation at the match line, the use a match line chain to locate where the match line profile elevation is to be applied is the best option. The chain and profile can be easily obtained using the Profile Grade Report. **Note:** The use of a match line chain is not required; it is just the easiest option. To use the typical section option, the appropriate slope width redefinable variable would need to be large enough to extend past the match line location.

The Define Variables Match Line Chain Names, Left Match Line Profiles and Right Match Line Profiles list the chains and profiles to be used with match lines. The match line chain names must exactly match the corresponding profile name. Commas must separate the profile and the chain names. Example: “ml1lt,ml2lt,ml3lt”; or “ml1rt,ml2rt,ml3rt”. Up to eight match line chain names are permissible per cross-section run. **IMPORTANT:** The list of the match line chains MUST NOT include any blank spaces. The stationing of the match line chain and corresponding profile must be the same. Also, the presence of a defined match line chain **ALWAYS** "overrides" a graphic match line.

The Redefinable Variable _d_MatchLineChainSearchDistance sets the distance to look for a match line chain. The distance is measured in master units from the edge of shoulder, curb, or berm. This is a positive value and **MUST** be greater than zero.



Example Using a Match Line Chain and Profile

Appendix 13 Rock Benches

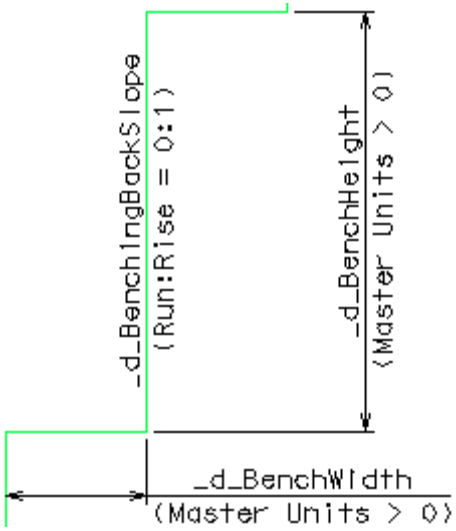
Drawn by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon) as part of the Standard Side Slopes.

Cross-Section Geometry Required

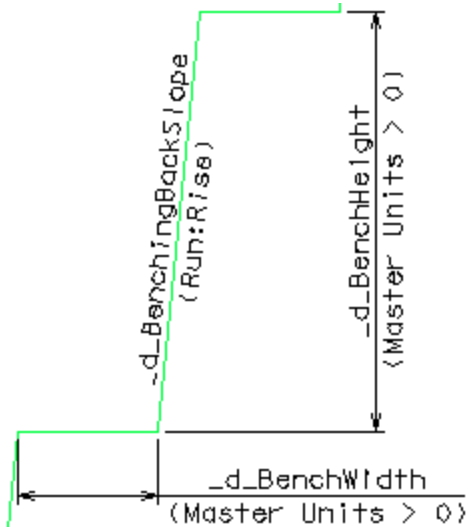
If the proposed ground is below a top of rock line in the cross-section, rock benches are drawn starting at the back of the ditch. For this to work, the top of rock line must be drawn in the designated Cross Section DGN using symbology matching the search parameters for the **D&C Manager** item **Rock Top**, which is located in the path: "**Design Standards/Cross Sections/Existing Surfaces/**".

Rock Bench Redefinable Variables

Four redefinable variables control how the rock benches are drawn. The bench width and the bench height are set by _d_BenchWidth and _d_BenchHeight, respectively, in master units, which must be greater than zero. The rock face can either be vertical or drawn at an inclined slope, which is set by _d_BenchingBackSlope, in Run:Rise format. Rise is ALWAYS a positive number. For a vertical face set _d_BenchBackSlope to 0:1. For an inclined face the Run value is the percent of slope from vertical divided by 100. Consequently, to have a 10% slope to the incline, use a value of 0.1:1, as shown in the following figures



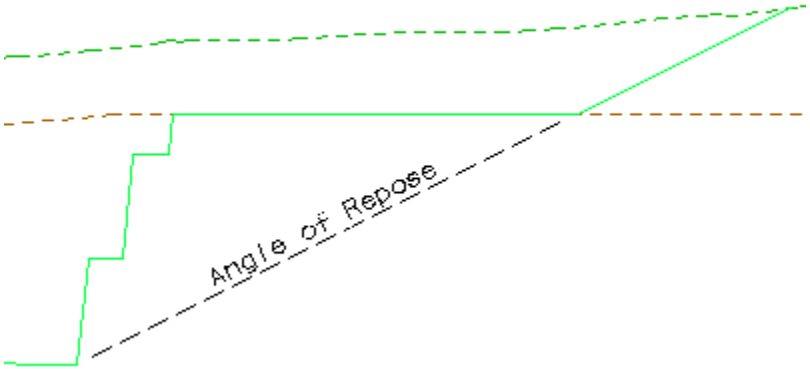
Vertical Rock Face (_d_BenchBackSlope = 0:1)



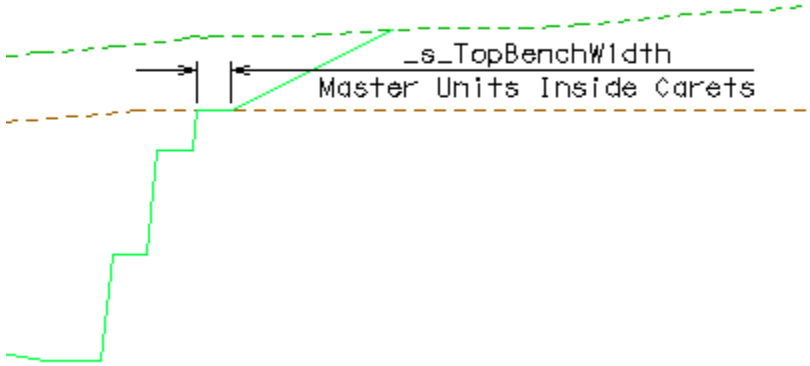
Inclined Rock Face (_d_BenchBackSlope = Run:Rise)

The fourth rock bench redefinable variable is _s_TopBenchWidth, which locates the toe of the slope for the Class A material above the rock. Two options are available. The toe can be located either at the angle of repose, which is the angle of the ditch back slope

projected from the back of the ditch as shown in the figure on the left below, or at a specified horizontal distance (in master units) from the rock face as depicted in the figure on the right. Set _s_TopBenchWidth = ^RS^ for angle of repose slope or put the horizontal distance between carets (example ^10^) to specify an actual width. The carets "^" are required. **Note**: For the slope to be drawn correctly, the existing ground line must extend far enough for the proposed ground line to intersect it. Inconsistent results will occur if the existing ground line is not wide enough.



Example: _s_TopBenchWidth = ^RS^
Toe of Slope at Angle of Repose Slope



Example: _s_TopBenchWidth = ^10^
Toe of Slope at 10' From Rock Face

Appendix 14 Sidewalk

Drawn by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

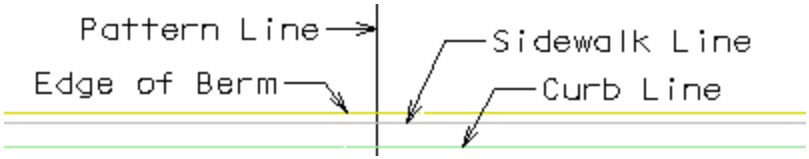
Plan View Geometry

Two conditions need to be met for sidewalk to be drawn in a cross-section. The first is that the edge of sidewalk is drawn in the designated Proposed Plan DGN. The line must be drawn using the **D&C Manager** item **Sidewalk** located in the D&C Manager path: "**Design Standards/Roadside/**". The second condition is that the sidewalk is located within the Berm in the Standard Side Slopes.

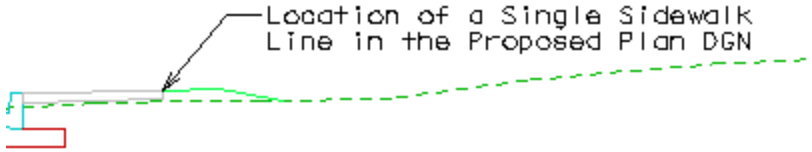
If the sidewalk is adjacent to the back of a curb, only one edge of sidewalk line away from the back of the curb is to be drawn. However, if the sidewalk is not adjacent to a back of curb, both edge of sidewalk lines need to be present. The sidewalk will not be drawn if the criteria cannot match up an edge of sidewalk line with either a curb line or another edge of sidewalk line. The required lines and the results are given in the following examples (**Note**: The width of the sidewalk is determined by the plan view geometry):

Example 1: Sidewalk Adjacent to Back of Curb

The sidewalk is drawn between the back of curb and a single sidewalk line:



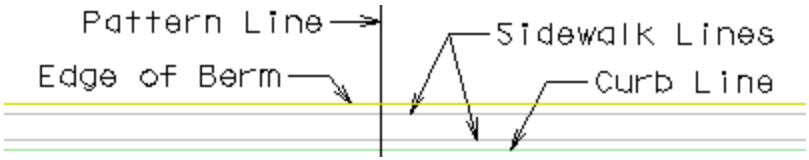
Plan View Geometry With One Sidewalk Line



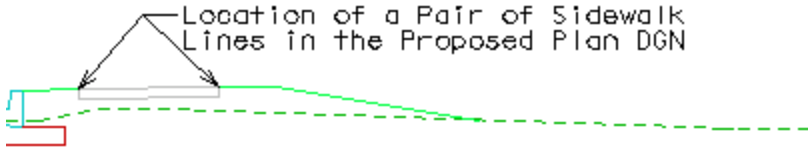
Cross-Section View

Example 2: Sidewalk Away from Back of Curb

The sidewalk is drawn between two matching sidewalk lines:



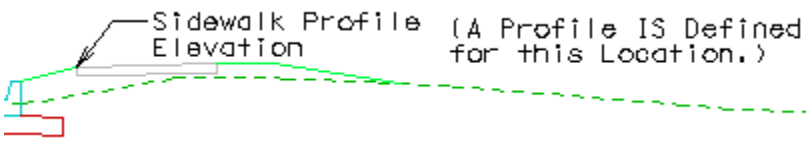
Plan View Geometry With Two Sidewalk Lines



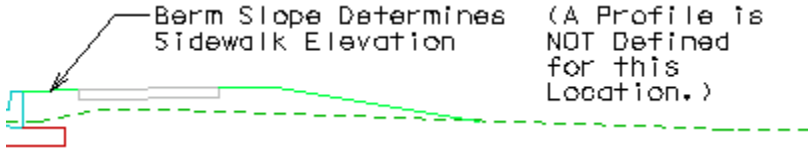
Cross-Section View

Sidewalk Elevation

The elevation of the sidewalk in the cross-section view is set by the elevation assigned to the inside edge of the sidewalk. This elevation can be determined either by the slope of the berm or by a previously defined profile. The Define Variables Left Sidewalk Profiles and Right Sidewalk Profiles list the profiles to be used with a sidewalk for each side of the cross-section. If a sidewalk profile is defined for the cross-section station and side, the inside edge of the sidewalk is started at the profile elevation for that station, as shown in the figure on the left below. If a sidewalk profile is NOT defined for the cross-section station and side, the elevation of the inside edge of the sidewalk is set by the cross-section geometry. If the sidewalk starts at the back of a curb, the inside edge of the sidewalk is drawn at the elevation of the back of the curb. If the sidewalk is drawn between two sidewalk lines, the berm slope is projected to the inside sidewalk edge, which is the starting elevation for the sidewalk, as shown below in the figure on the right.



Cross-Section With a Sidewalk Profile Defined

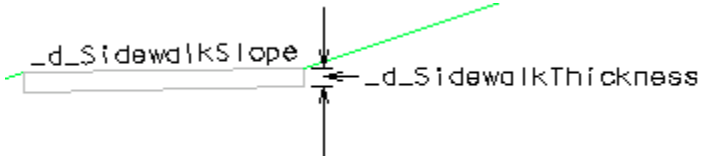


Cross-Section Without a Sidewalk Profile Defined

The elevation of the outside edge of the sidewalk is controlled by the redefinable variable _d_SidewalkSlope, which sets the proposed sidewalk cross slope in percent format from the inside edge to the outside edge, as shown in the figure below. Do not include the percent sign. Do include the negative sign when applicable.

Sidewalk Thickness

The redefinable variable _d_SidewalkThickness sets the sidewalk thickness in master units, as shown in the following figure. This is a positive value and MUST be greater than zero. **Note**: The width of the sidewalk is determined by the plan view geometry.



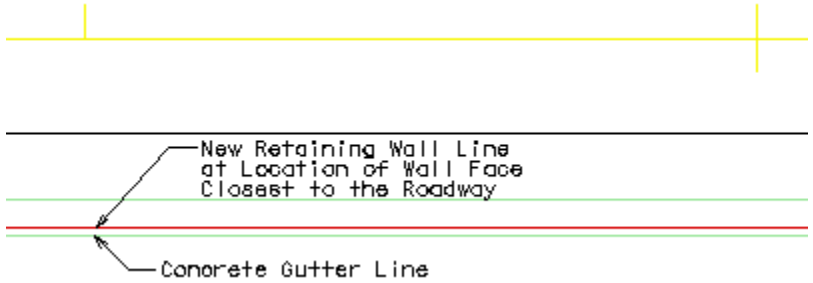
Sidewalk Dimension Redefinable Variables

Appendix 15 Retaining Walls

Drawn by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

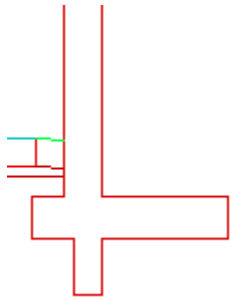
Plan View Geometry

Retaining walls are located in the proposed side slope by placing a new retaining wall line in the designated Proposed Plan DGN at the location of the face of the wall closest to the roadway. The line must be drawn using the **D&C Manager** item **New Retaining Wall** located in the D&C Manager path: "**Design Standards/Safety and Structures/**", as shown in the figure to the right. The retaining wall may be located either adjacent to a shoulder or proposed ground. A gutter can be place behind the wall by locating a Concrete Cutter line at the backside of the wall in cut (D&C Manager path: "**Payitems/Roadway/Curb/**"). See Appendix 11 for placing a retaining wall in Medians.



Proposed Surfaces Adjacent to the Wall

If the retaining wall is to be placed adjacent to the shoulder, two conditions must be met for the cross-section to be drawn correctly. The first is that there must be a gap between the retaining wall and the shoulder as drawn in the cross-section. This is required for the criteria to recognize the retaining wall line in the plan view. Typically, joint filler is placed between the retaining wall and the shoulder and the width of the gap can be used to represent the joint filler thickness. For non-earth shoulders, the second condition is that the shoulder must be recognized by the criteria as concrete regardless of the actual material used. This is required so that the outer edges of the shoulder layers are drawn vertically next to the wall. If the edge of the shoulder is within the distance in master units set for the redefinable variable _d_AdjacentWallSearchDistance, the aggregate layer will be extended to the wall as shown in the figure to the right. Use a positive number.



If proposed ground is adjacent to the retaining wall, a maximum of two different slopes are permitted before the retaining wall. The value of these slopes are the slope assigned to the berm (if one is drawn) and to the first fore slope after the berm that is actually drawn. The fore slope that is applied depends on whether the side slope is in cut or fill and the side slope parameters applied to the cross-section.

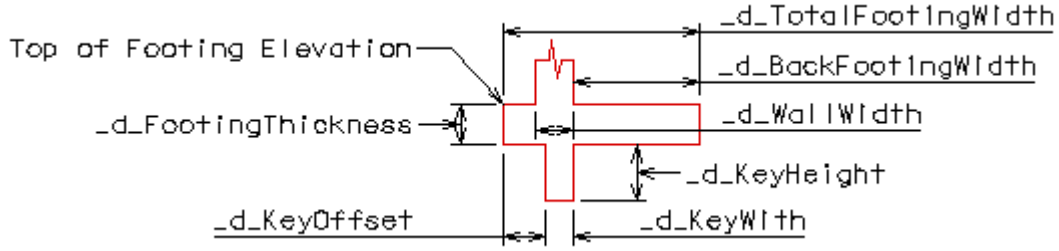
Go to: Standard Side Slopes

Footing Cross-Section Details

The dimensions for drawing the retaining wall footing are set by the redefinable variables _d_WallWidth (measured from the retaining wall line in the plan dgn in a direction away from the roadway), _d_BackFootingWidth (measured from the edge of the wall with the deepest fill to the back or heel of the footing), _d_TotalFootingWidth (measured from the back or heel of the footing to the front or toe of the footing), _d_FootingThickness (measured down from the top of the footing), _d_KeyHeight (measured down from the bottom of the footing), _d_KeyOffset (measured from the front or toe of the footing to the front edge of the key), and _d_KeyWidth (measured from the front of the key to the back of the key), as shown in the following figure. All values are in master units and may be zero or greater than zero. The back footing width will always be drawn on the side of the wall with the deepest fill above the footing.

The elevation of the top of the footing can be set by either defining a top of footing profile or by a minimum depth below ground. To specify a top of footing elevation, create a profile based on the cross-section station. Different profiles may be used for the median, left, and right side and are listed using the define variables Median Top of Footing Profiles, Left Top of Footing Profiles and Right Top of Footing Profiles respectively. These profiles must be previously stored in COGO before processing the cross sections. The profile names are to be separated by commas. Example: LTF1,LTF2,LTF3 or RTF1,RTF2,RTF3. If the top of footing profile exists for the cross-section station, the elevation for that station will be used as the top of footing elevation.

If a top of footing profile does not exist for the station, the top of footing is drawn at a specified depth below either the proposed or existing ground line, whichever is lower. If the proposed ground is lower, the wall is in cut and the top of footing is below proposed ground by the distance specified by the redefinable variable _d_DepthBelowProposedGroundInCut. However, if existing ground is lower, the wall is in fill and the top of footing below existing ground by the distance specified by the redefinable variable _d_DepthBelowExistGroundInFill. Both values are in positive master units.



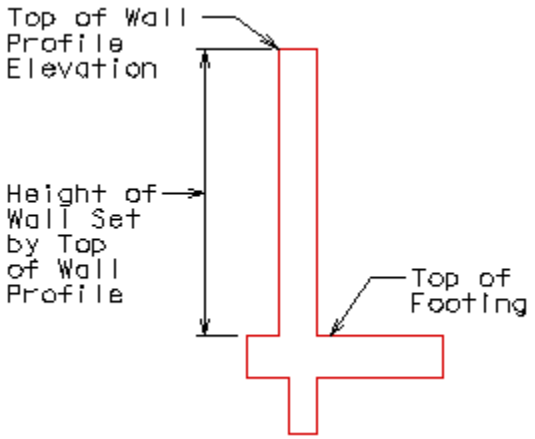
Retaining Wall Footing Dimensions

Retaining Wall Height

The height of the retaining wall may be set by specifying the elevation of the top of the wall, by defining a specific height, or by letting it vary with the ground surface. A profile is used to set a specific elevation for the top of the wall based on the cross-section station. If a top of wall profile does not exist for the cross-section station, the redefinable variable _s_WallHeight controls the height of the wall. This variable can be set to specify a fixed value for the height of the wall or it can be set to allow the height of the wall to vary with the ground surface.

Height Set by Elevation of the Top of the Wall

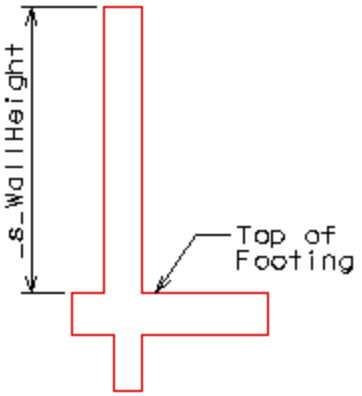
To set the wall height by specifying a top of wall elevation, create a profile based on the cross-section station. Different profiles may be used for the left and right side and are listed using the define variables Left Top of Wall Profiles and Right Top of Wall Profiles respectively. These profiles must be previously stored in COGO before processing the cross sections. The profile names in the list need to be separated by commas. Example: LTW1,LTW2,LTW3 or RTW1,RTW2,RTW3.



If the of top of wall profile exists for the cross-section station, the elevation for that station is used as the top of wall elevation and the wall is drawn between the top of the footing and the top of wall elevation, as shown in the figure to the right. The proposed ground settings are used to connect the retaining wall to the existing and the proposed ground. The rest of the parameters for the wall and footing dimensions are the same as those shown on the previous page.

Height Set by a Fixed Value

The redefinable variable _s_WallHeight controls the height of the wall if a top of wall profile is not used. As a string redefinable variable (as defined by the beginning "_s_"), it is used to control whether the height of the wall is a fixed height or variable. If a fixed height is desired, set the variable to a numeric value inside of carets (^). Example: Assign it the value of ^10^ for a 10 foot high wall. AWAYS use the carets.



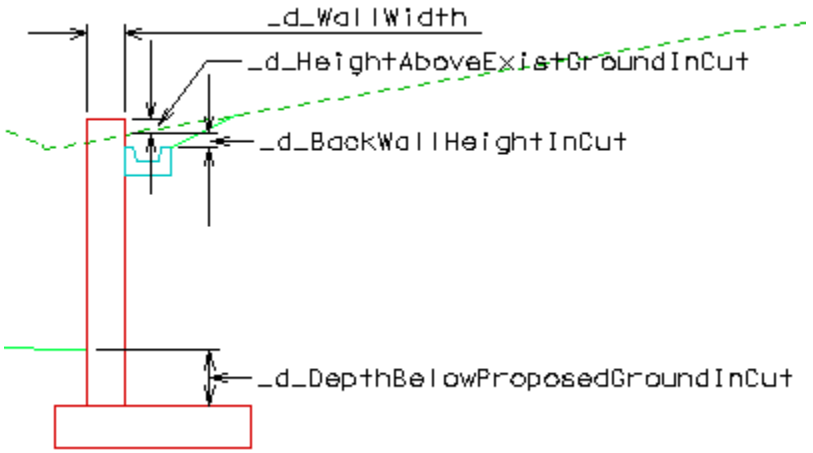
The fixed height of the wall is measured up from the top of the footing in master units, as shown in the figure to the right. The proposed ground settings are used to connect the retaining wall to the existing and the proposed ground. The rest of the parameters for the wall and footing dimensions are the same as those shown on the previous page.

Height Varies With the Ground Surface

To let the height of the wall vary with the ground surface, set _s_WallHeight to ^GS^ for ground surface. AWAYS use the carets. With the variable set to this value, different parameters are allowed for cut and fill. Each of these cases is considered separately.

Variable Wall Height in Cut

If _s_WallHeight is set to ^GS^ and the wall is in cut, the redefinable variable _d_HeightAboveExistGroundInCut controls the top of the wall by specifying the distance in master units that the top of the wall is above the existing ground on the back side of the wall, as shown in the figure to the right.

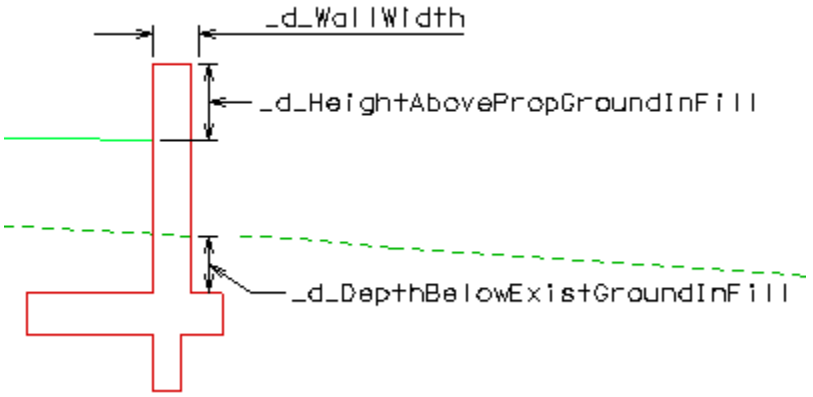


If a gutter is to be drawn on the backside of the retaining wall the redefinable variable _d_BackWallHeightInCut controls the distance in master units that the top the gutter is below existing ground, as shown to the right.

If a profile is not used to locate the top of the footing, the redefinable variable _d_DepthBelowProposedGroundInCut controls the depth of the footing below the proposed ground surface as indicated in the figure to the right. This distance is in master units.

Variable Wall Height in Fill

If _s_WallHeight is set to ^GS^ and the wall is in fill, the redefinable variable _d_HeightAbovePropGroundInFill controls the top of the wall by specifying the distance in master units that the top of the wall is above the proposed ground on the roadway side of the wall, as shown in the figure to the right.



If a profile is not used to locate the top of the footing and the wall is in fill, the redefinable variable _d_DepthBelowExistGroundInFill controls the depth of the footing in master units below existing ground as indicated in the figure to the right. Both sides of the wall are checked and the lower elevation is used.

The rest of the dimensions for the retaining wall are the same as those used in the section dealing with the retaining wall footing.

Appendix 16 Tapering Procedure

Drawn by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon).

In certain design situations a designer may need to "Taper" ditch widths or ditch slopes over a certain distance. For example, a design requires the slope of the side embankment to transition from a default Standard Side Slopes value to another one that is used for a short section of the project. This can be done using tapering files. When a typical section is applied two special files are copied to the working directory. Initially these file names are TapersLT.txt and TapersRT.txt for the left and right sides respectively. These files can be renamed as long as the new file names are assigned to the variables Left Tapers File Name and Right Tapers File Name.

Taper File Content

The original content of one these files is as follows:

BL,Station,Reg,#BW,#FS1W,#DFS1W,#DW,#BrmS(%),:FS1(Rn:-Rs),:FS2(Rn:-Rs),:DFS1(Rn:-Rs),:DFS2(Rn:-Rs),:BkS(Rn:Rs),:FCS(Rn:Rs),:FFS(Rn:-Rs)
$End

The abbreviation definitions are as follows:

BL	=	Shape Cluster Baseline Name;
Station	=	Station at which the values of the current line are to be applied;
Reg	=	Region;
BW	=	Berm Width;
FS1W	=	Fill Slope 1 Width;
DFS1W	=	Ditch Fore Slope 1 Width;
DW	=	Ditch Width;
BrmS(%)	=	Berm Slope in percent format with the percent sign;
FS1(Rn:-Rs)	=	Fill Slope 1;
FS2(Rn:-Rs)	=	Fill Slope 2;
DFS1(Rn:-Rs)	=	Ditch Fore Slope 1;
DFS2(Rn:-Rs)	=	Ditch Fore Slope 2;
DkS(Rn:Rs)	=	Ditch Back Slope;
FCS(Rn:Rs)	=	Forced Cut Slope; and
FFS(Rn:-Rs)	=	Forced Fill Slope.

For the user to utilize tapering, the left or right or both file(s) need to be edited. This can be done with a standard text editor or a Visual Basic Application (VBA) launched from D&C Manager (v8 only). The values put into this file over ride the values set by the redefinable variables in the proposed cross section run. An example using at text editor is presented first, followed by one using the VBA.

Tapering Example

This example use standard slopes and only tapers the width of the bottom of the ditch and ditch foreslope 1 for the LEFT ditch only. The taper specifics are as follows:

Baseline Name = Prop
Region = 1
station 24+00 ditch width = 2 and ditch foreslope 1 = 6:-1
station 26+00 ditch width = 4 and ditch foreslope 1 = 4:-1
station 28+00 ditch width = 2 and ditch foreslope 1 = 6:-1

The “rules” for the file are as follows: Enter zeros for items that are not changing and nonzero values for the items that are changing. Place a common, without a space, between the values. Only the station ranges through the tapered area are in the file. If a particular element is not to taper then zeros are used as placeholders. When using the zeros you must however keep with the format of using the colon and showing both the run and rise i.e. "0:0". The file format MUST not be altered. The "+" sign for the station is REQUIRED. The "-" minus sign for the rise value of ditch fore slopes and fill slopes are REQUIRED. The ":" colons between the run and rise are REQUIRED. There are NO BLANK SPACES allowed in this file. The default first and second lines MUST NOT be deleted. The data must go in between the default lines as shown above. All fields MUST be present. Lastly, note that the baseline name, station, and region are ALWAYS required.

File edited using a text editor

Great care needs to be taken if a regular text editor is used to edit the tapers file. The format of the file is **VERY** specific and the following example MUST be followed precisely for it to work. For the example, the original file needs to be edited by adding three lines between the first and last lines, one for each station at which the tapering transitions. The contents of the edited file are shown below:

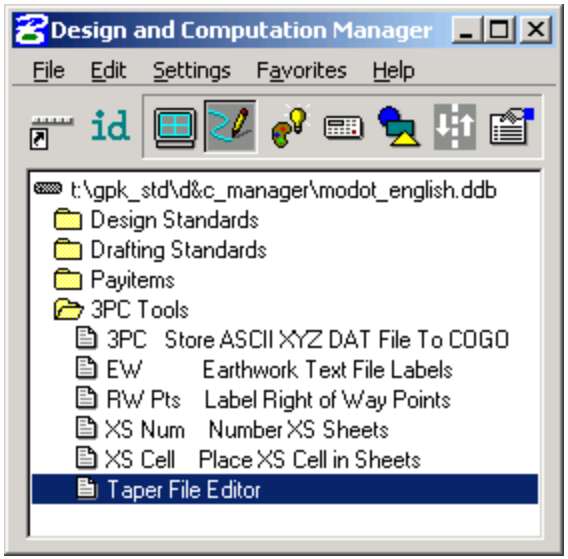
```
BL,Station,Reg,#BW,#FS1W,#DFS1W,#DW,#BrmS(%),:FS1(Rn:-Rs),:FS2(Rn:-Rs),:DFS1(Rn:-Rs),:DFS2(Rn:-Rs),:BkS(Rn:Rs),:FCS(Rn:Rs),:FFS(Rn:-Rs)
prop,24+00,1,0,0,0,2,0,0:0,0:0,6:-1,0:0,0:0,0:0,0:0
prop,26+00,1,0,0,0,2,0,0:0,0:0,4:-1,0:0,0:0,0:0,0:0
prop,28+00,1,0,0,0,2,0,0:0,0:0,6:-1,0:0,0:0,0:0,0:0
$End
```

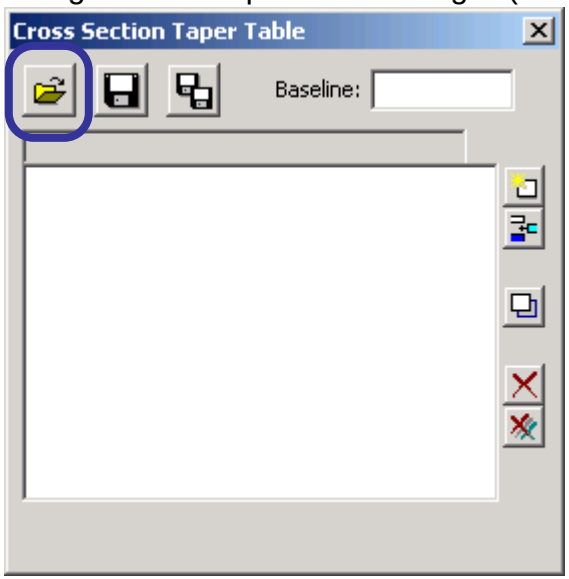
Notice in the above example how only the value of the ditch width and ditch fore slope 1 change. These are shown in red, while the commons that separate the values and the placeholders for the items that are not tapering are in black.

Once the file has been edited, it should be saved using a different file name. This prevents the user from over riding the text file when an additional typical section is applied. The saved file name is entered as the value for the Tapers File define variable.

File edited using VBA

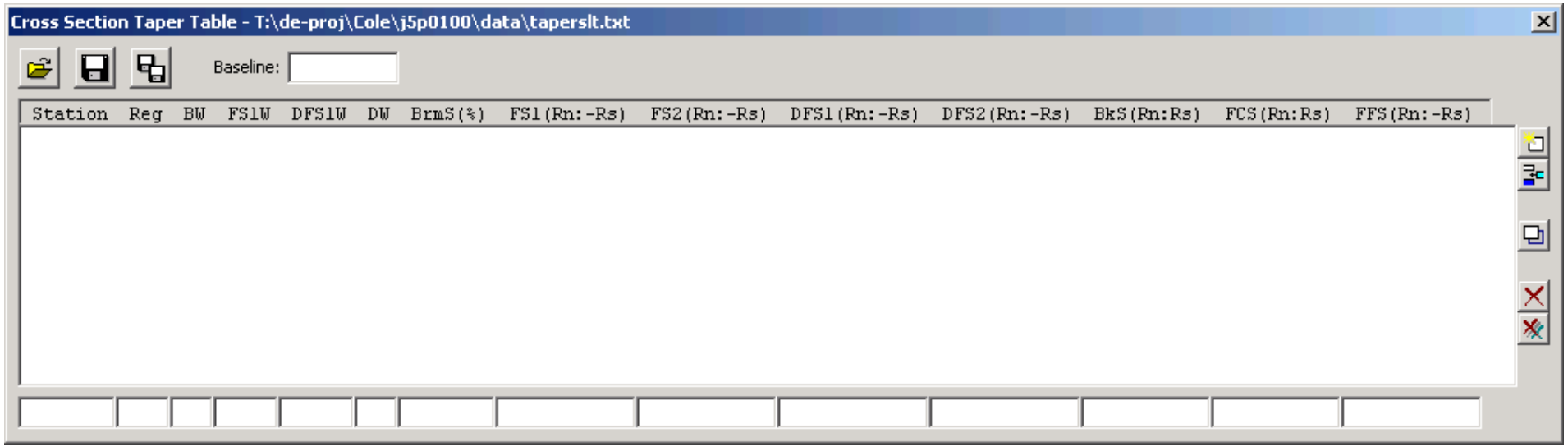
The second way that the tapers file can be edited is by running a VBA launched from the Design and Computation Manager (v8 only). In the design mode, double click on **Taper File Editor**, which is in the 3PC category, as shown in the figure to the right. This launches the **Cross Section Taper Table** dialog shown to the left.



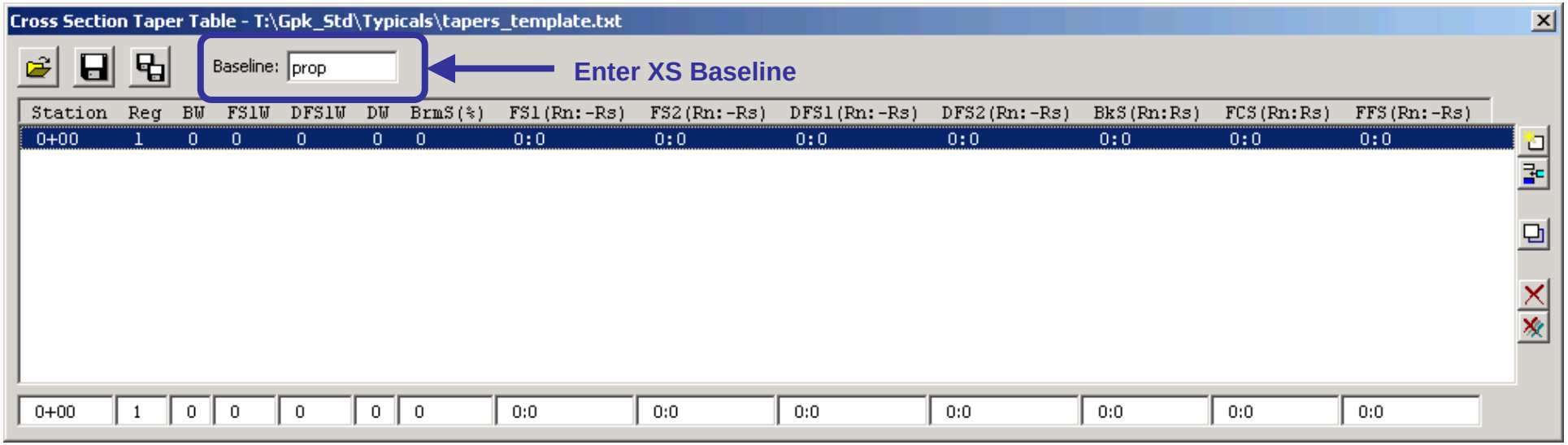


To begin working on tapers file, click on the **Open** file button, which is the one outlined in the figure. The user has two options for selecting the first tapers file to be edited for the project. It may be selected from either the working directory for job or from the t:\gpk_std\Typicals folder.

If the typical section was applied using GEOPAK 2004 or later, one of the tapers files in the working directory may be used. However, if this option is chosen, the user will need to enter all of the values for the initial line to be added to the text file. This is because this file contains only two lines, which are the header and the end lines. As shown in the following figure:



To keep from adding all of the information, a tapers template file has been created. It is **t:\Gpk_Std\Typicals\tapers_template.txt**. This file has three lines of text with the middle line containing default values. Loading this file causes that additional line to be included in the list box with its values displayed in the edit boxes at the bottom of the dialog, as shown in the following figure. Noted that the required plus sign "+" and colons ":" have been added.

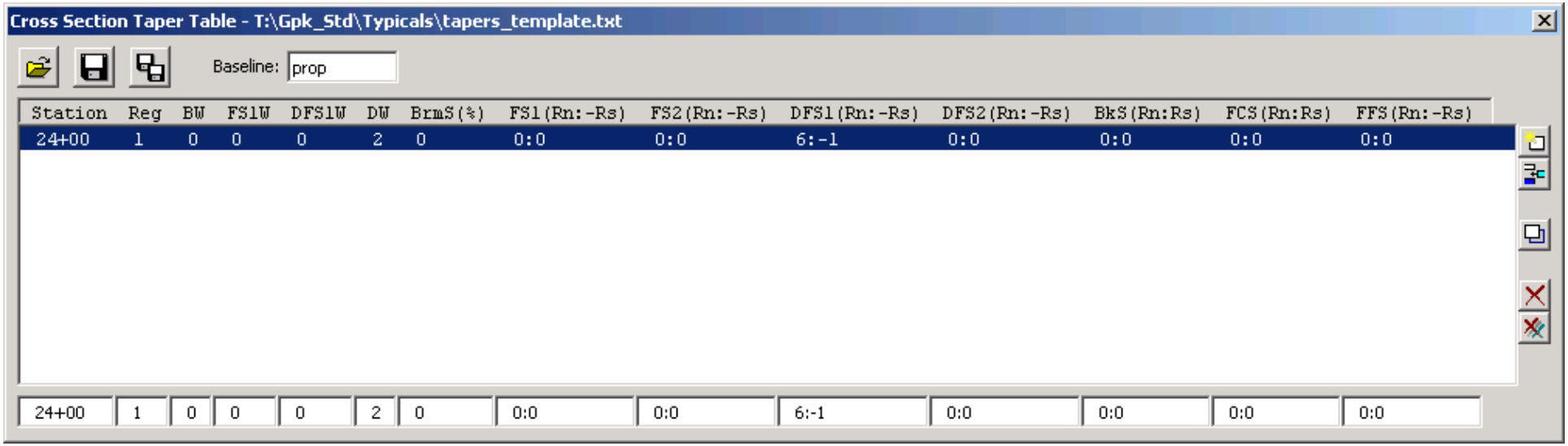


To edit the file, enter the cross section baseline chain in the **Baseline** field, as shown above. This baseline will be added to all of the lines containing tapering information. To add the rest of the information to an individual line, change the information in the boxes at the bottom of the dialog to the required values. The boxes line up vertically with the header information at the top of the dialog. After entering the information for an individual field, the tab key moves the cursor to the next field and selects the text in that field.

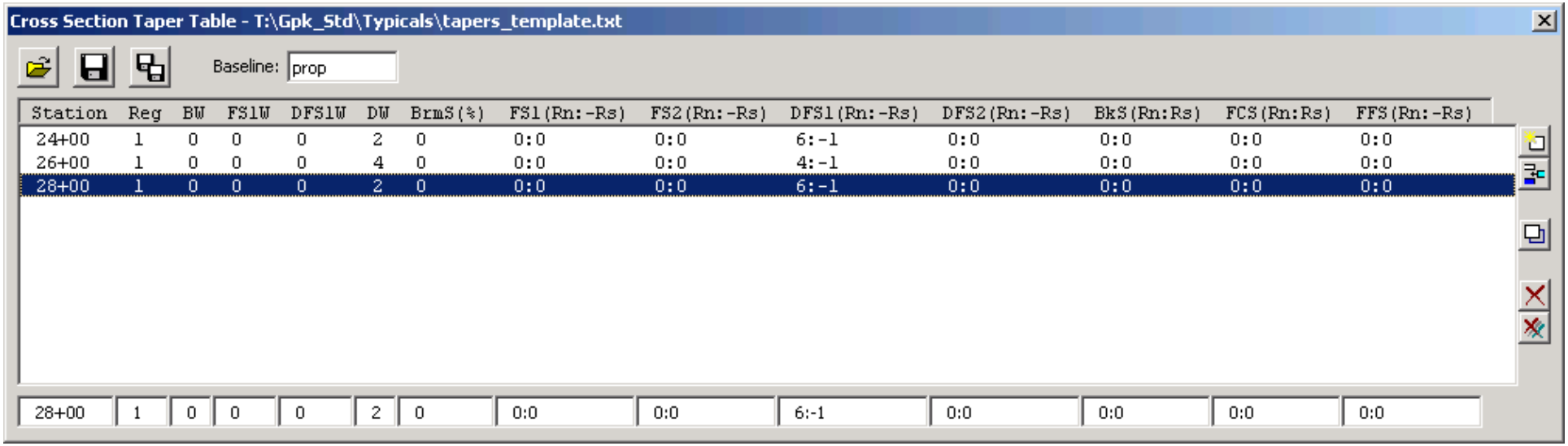
Once the boxes are correct, that information can be added to the list box using the buttons on the right edge of the dialog. They function as follows:

- Adds a new line after the current line.
- Inserts a new line above the current line.
- Modifies the highlighted or current line.
- Deletes the highlighted or current line.
- Deletes all rows from the list box.

The required information for the first line of the example has been added to the loaded file and the Modify icon used to update the information in the current line in the list box, as shown below:



After adding the rest of the information for the example, the completed dialog is shown in the following figure:



Two icons are provided to save the file. They are located next to the Open file Icon and perform the following functions:

 Save

 Save As

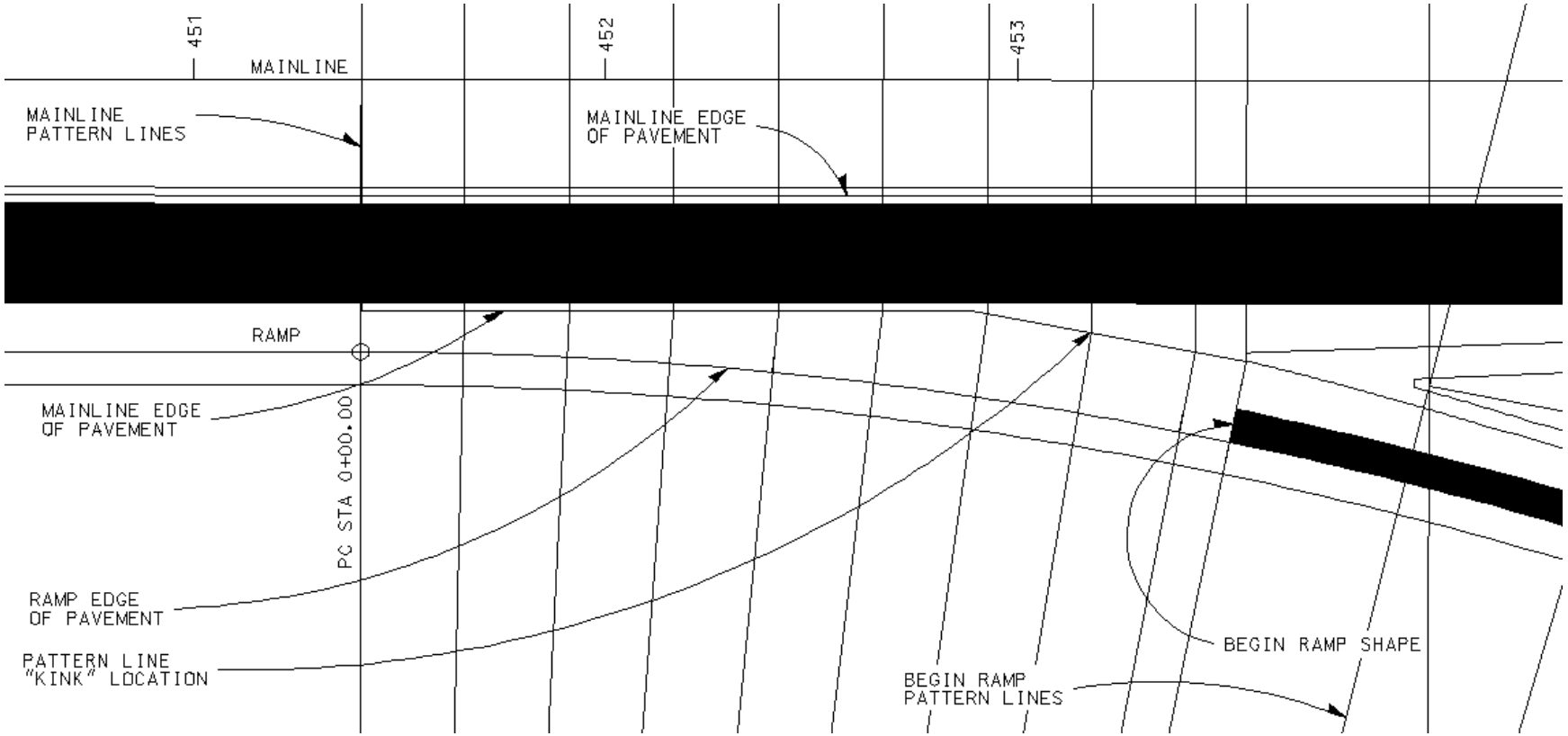
Since the template file was used for this example, the **Save As** button is required to be used so that the edited file can be saved to the working directory. After navigating to the working directory, the file is saved as tapers_example.txt. The application displays the following dialog to confirm that the file has been saved. Click on **OK** to close this **Save Table File** dialog.

Appendix 17 Gore Areas

Drawn by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon) as an option in Standard Side Slopes.

Paved Gore

There are some restrictions on the "Main Line" pavement shapes and pattern lines. The shapes should not take into account the ramp transition but the pattern lines should. The main line pattern lines needed to be line strings with a kink in the pattern line located where the change in slope from mainline cross slope to ramp cross slope takes place with each segment of the line string perpendicular to its respective chain. The ramp shape and pattern lines, which should not be generated until later, will begin at the ramp nose, which is at the end of the ramp transition were the ramp pavement separates from the main line pavement, as shown in the following figure.



Ramp Transition Chain and Profile Design Procedure

Based on MoDOT standards, the outside elevation of the ramp transition is controlled by the main line profile, the main line cross slope out to the kink in the pattern line, the cross slope of the ramp from the kink to the ramp chain, and the location or the ramp chain. Moreover, the cross slope of the ramp is in transition from the start of the ramp chain (where it matches the cross slope of the mainline) to the ramp nose (where it matches the full superelevation required by the ramp curve). For this reason, a point to point profile needs to be created for this region along the ramp chain. This is best done using the **Shape Analyst** and **Shape Profiler** in **Superelevation Shape Manager Tools**, as described in the **Ramp Transition Exercise**, which is located at the following link:

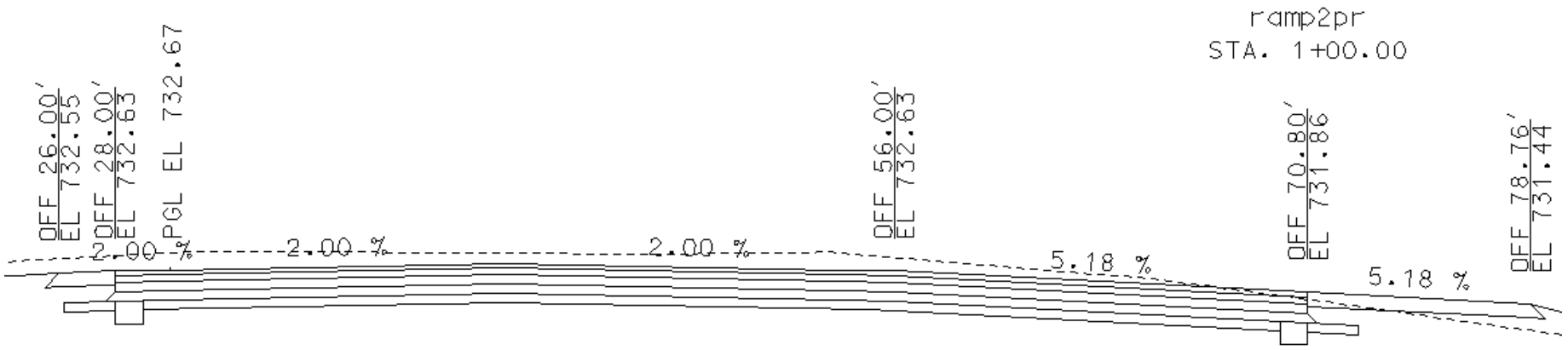
External MoDOT Web: http://www.modot.mo.gov/business/GEOPAK_HELP2.htm

The name of the profile needs to be exactly the same as the name of the chain created along the outside edge of the ramp. If, for instance, the ramp chain is called RAMP2PR, the ramp transition profile needs to be named Ramp2PR as well. The name given to the ramp transition chain and profile needs to be included in the value for the variable Ramp Chain Names. Also, for the criteria to find the chain, the distance from the outside edge of the mainline to the ramp chain must be less than the value of the redefinable variable _d_RampChainSearchDistance.

There are two ways to prevent the criteria from finding the ramp chain past the ramp nose. One is to create a unique chain and profile for just the ramp transition that are a portion of the chain and profile for the entire ramp. The other is to limit the value of the variable _d_RampChainSearchDistance so it is less than the distance from the mainline edge of pavement to the ramp chain after the nose.

Cross-Section Details

The pavement structure for the ramp transition is the same as the main line pavement, as show below.

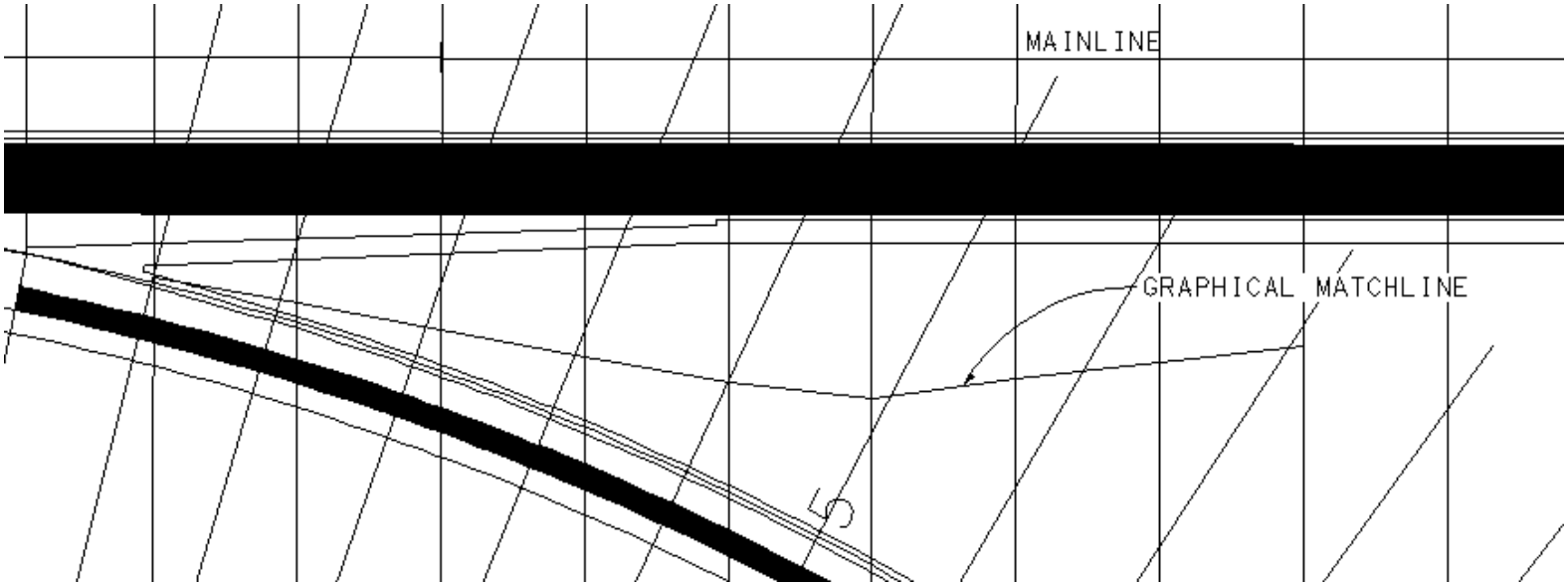


Grass Infield Gore

A grass infield gore is required when there are two roadway close enough to each other so that it is not possible for the side slopes for both roadways to tie to existing ground. This often is the case between a main line alignment and a ramp or outer road, as shown below. The first issue that needs to be resolved is which roadway controls the elevation of the ditch between the two roadways. In most cased this can be determined from a comparison of the two profiles and the required ditch depths. Subtracting a roadway's ditch depth and the difference in elevation between the profile and the start of the side slope from the profile elevation gives the maximum elevation of the ditch for that roadway. The controlling roadway is the one with the lower maximum ditch elevation. If this comparison does not give a clear indication of which roadway controls, a set of preliminary cross sections can be run for each roadway with the redefinable _s_DrawDitchesInPlanView set to ^Yes^. This will not only give the ditch elevation for each roadway but will also plot the location of the ditch in the designated Proposed Plan DGN.

Plan View Geometry

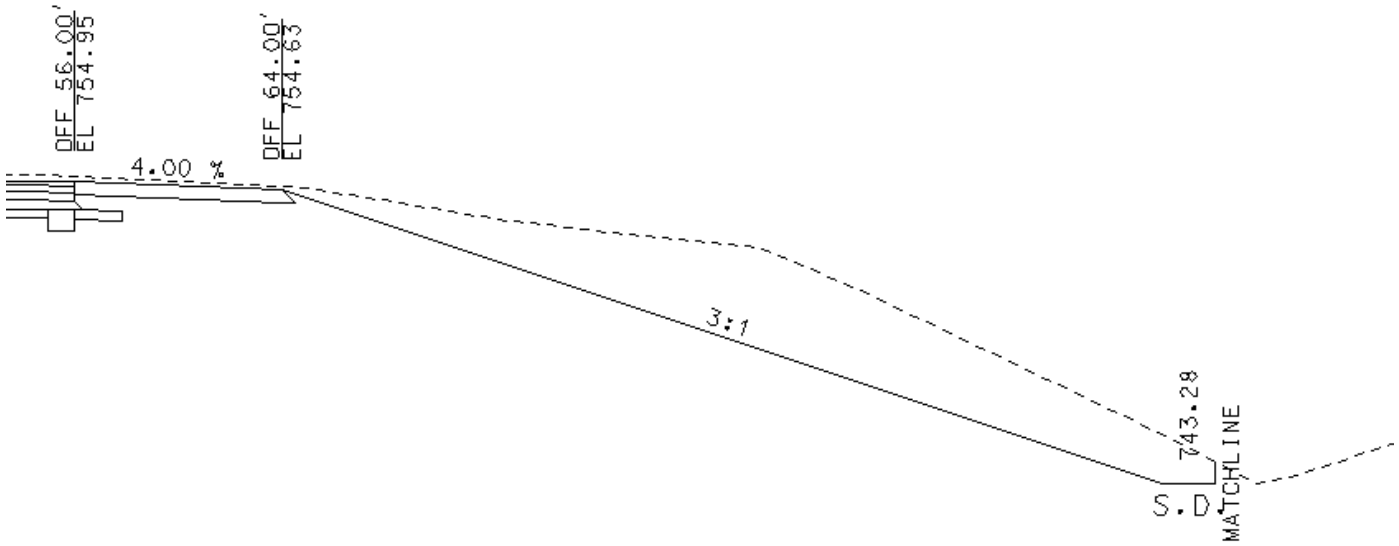
Once it has been decided which roadway controls, the next step is to use Draw Transition or another tool to draw a line in the GEOPAK Lines DGN at the controlling out ditch using the **D&C Manager** item **Matchline**, which is located in the D&C Manager path: "**Design Standards/Roadway/**", as indicated in the following figure.



Although the figure on the precious page does not show it, it is a good idea to add pattern lines for the controlling roadway were the graphical match line intersects the pattern lines for the non-controlling roadway. This is because the proposed cross-sections for the non-controlling roadway are drawn to a match line chain and profile created from the out ditch points for the controlling roadway. To draw directly to those points it is necessary for the match line profile to be accurately defined at those locations using the procedure outlined below.

Cross-Section Details for the Controlling Roadway

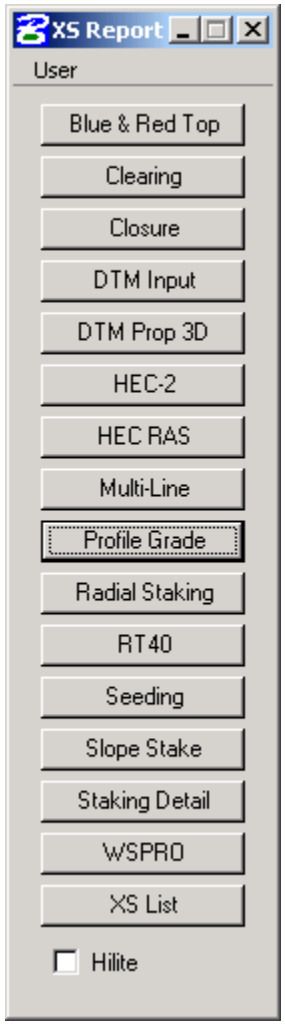
With the match line plotted, a final set of cross-sections can be drawn for the controlling roadway. The proposed cross-section are drawn normally out to the match line. At that point the proposed ground is drawn vertically (up or down) until it intersects with existing ground. See the following figure.

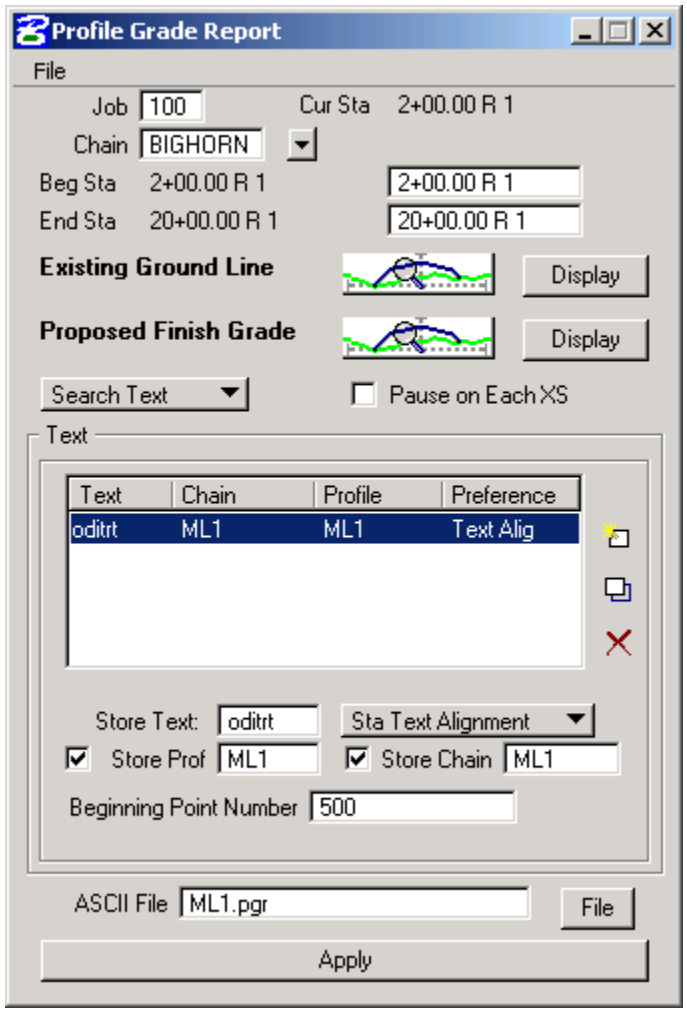


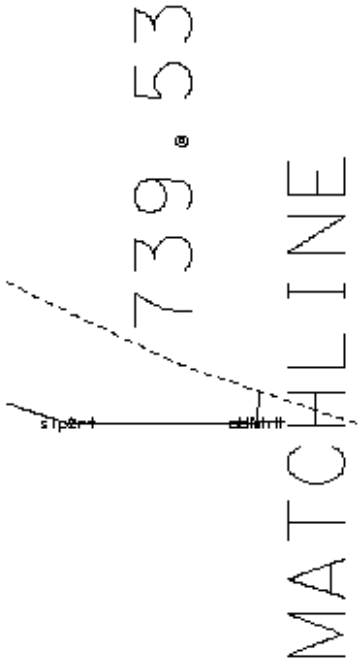
Also plotted with the geometry that is shown on the final cross section sheets, the typical section generator criteria file also draws text at several locations that can be used to generate a Profile Grade report. This report is used to create a match line chain and profile for the non-controlling roadway as described next.

Creating a Match Line Chain and Profile Using the Profile Grade Report

While in the cross-section file just created, the Profile Grade, which is one of the XS Reports (figure on the left), is used to create a match line chain and profile at the out ditch location. The Profile Grade Report, as set up in the middle figure, searchs each cross-section for the word “orditrt” and creates a chain and profile based upon the location of the text in the cross-section (figure on the right).



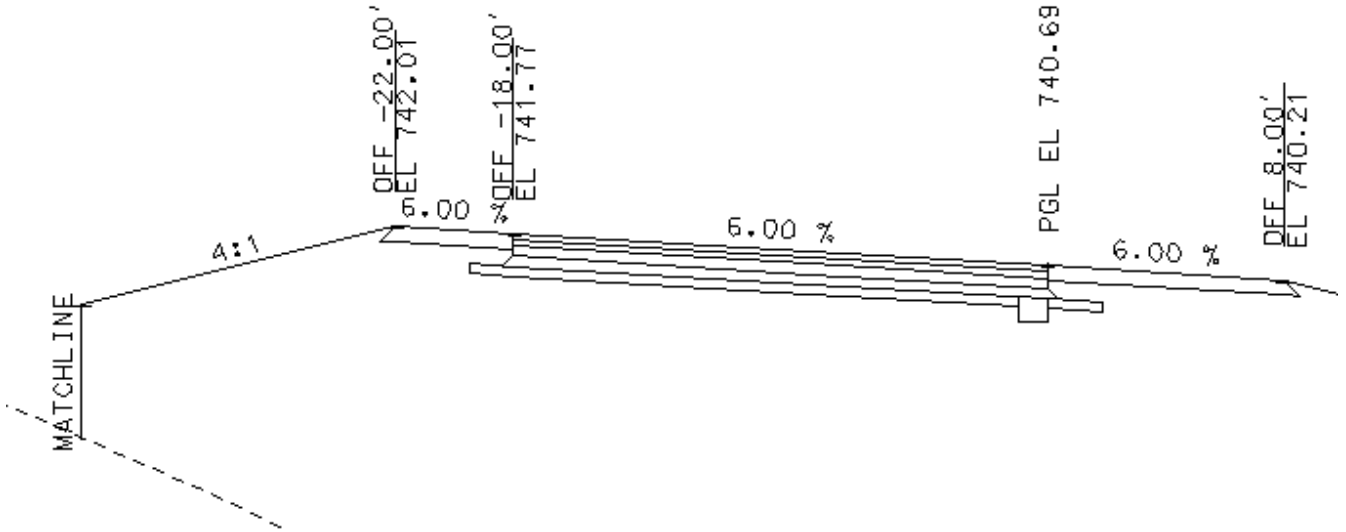




Match Line Cross-Section Details for Non-Controlling Roadway

Once the match line chain and profile are created, they are be used to terminate the proposed side slope for the non-controlling roadway. For this to work, the name given to the match line chain and profile (ML1 in this example) must be listed in the value for the variable Match Line Chain Names. The distance from the edge of shoulder, curb, or berm to the match line chain must be less than the value of the redefinable variable _d_MatchLineChainSearchDistance for the criteria to find the chain.

The proposed side slope is drawn from the edge of shoulder, curb, or berm to the match line chain and profile. An example of what that might look like in a fill situation is shown below:



Notes: Special Ditch Profiles may also be used to control the slope of the ditch that is drawn between the two roadways. This will affect the location and elevation of the match line and should be included in the set of cross-sections created prior to using the Profile Grade Report.

A Match Line example using the Profile Grade Report with MoDOT classic criteria is available at the following link:

External MoDOT Web: http://www.modot.mo.gov/business/GEOPAK_HELP2.htm

Appendix 18 Levee and Optional Interception Ditch

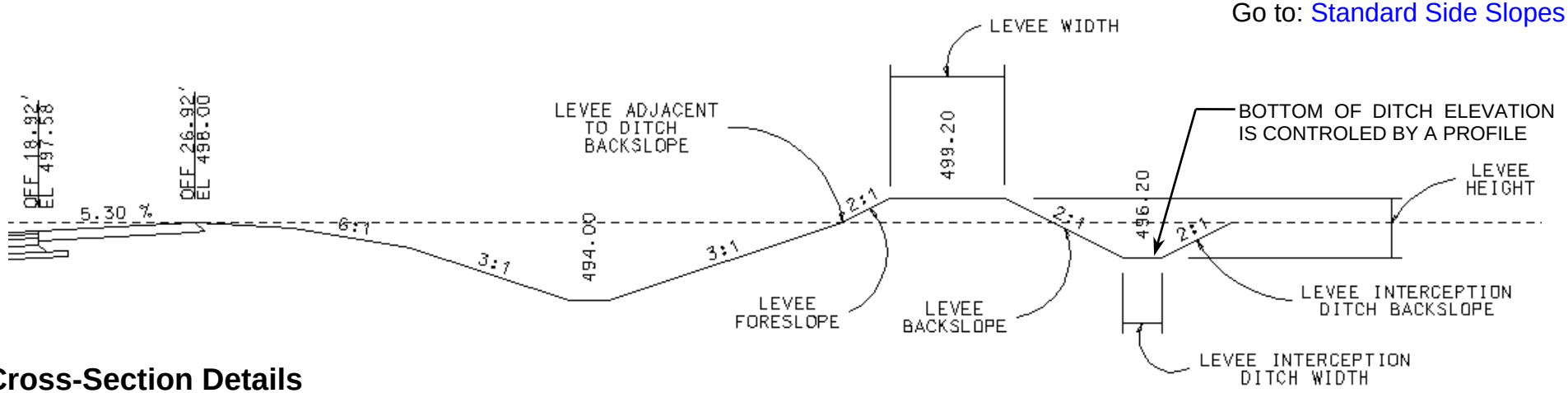
Drawn by all pavement typical sections (DNPavt, DRecon, NLtRRt, NRtRLt, UNPavt, & URECon) as an option in Standard Side Slopes.

Plan View Geometry

The levee can be located either adjacent to the roadway ditch or at some location beyond that. This behavior is controlled by the redefinable variable _s_LeveeAdjacentToDitch. Set its value to ^Yes^ to start the levee foreslope at the end to the ditch back slope (as shown in the following figure) or to ^No^ to have its location controlled by graphic elements drawn in the GEOPAK Lines DGN.

No matter where the levee is located, two plan view elements must be drawn outside of the ditch back slope tie down location using the **D&C Manager** items **In Levee** and **Out Levee**. These items are located in the D&C Manager path: "**Design Standards/Drainage/**". If _s_LeveeAdjacentToDitch is set to ^Yes^, these lines control only the width of the top of the levee and not its location. However, if _s_LeveeAdjacentToDitch is set to ^No^, the plan elements control both the "levee Width" and its horizontal location.

Go to: Standard Side Slopes



Cross-Section Details

The designer has the option of including an interception ditch behind the levee. If a ditch is desired, a bottom of ditch elevation profile must be defined for the cross-section station. Separate profiles may be created for each side and they must be listed in the variables Left Interception Special Ditch Profiles and Right Interception Special Ditch Profiles, respectively. If an interception ditch is not desired, do not define an interception ditch profile for that station. Four redefinable variables control the dimensions of the levee and interception ditch. They are _d_LeveeForeslope, _d_LeveeBackslope, _d_InterceptionDitchWidth, _d_InterceptionDitchBackslope, and _d_LeveeHeight, (which is measured from the bottom of the ditch profile as defined for the station or is measured from existing ground if a profile is not defined).

Appendix 19 Profile Grade Report Text

Text is plotted in the proposed cross sections that can be used with the Cross Section Profile Grade Report. The following subsections list the text that is plotted and what it represents. This information is listed twice. The first listing is organized by what is being marked. The second is organized by the text plotted, arranged in alphabetical order. All of this text is plotted on the same level and is graphically grouped. This text is part of the electronic deliverables and should not be deleted for cross sections that are not manually modified. For the cross sections that are modified, it would be best to move the text along with the elements that are modified. Placing the text in a MicroStation selection set overrides the graphic grouping. Also, turning the graphic group lock off allows the user to work with each piece of text separately.

Points Marked by Text in the Proposed Cross Sections

	Text Plotted	
Point Being Marked	**Left**	**Right**
Edge of Pavement	eplt	eprt
Edge of Shoulder	eoslt	eosrt
Curb Flow Line	fllt	flrt
Back of Curb Next to Pavement	boclt	bocrt
Back of Curb After U2 Shoulder	boc2lt	boc2rt
Berm	brmlt	brmrt
Bottom of Aggregate Base Daylight Point on Outside Slope	bdlslplt	bdlslprt
Bottom of Aggregate Base Daylight Point on Median Slope	bdlmedlt	bdlmedrt
Rock Fill Base Daylight Point on Outside Slope	rfbdllt	rfbdlrt
Rock Fill Base Daylight Point on Median Slope	fbdlmedlt	rfbdlmedrt
Compensating Depth Daylight on Outside Slope	compdllt	compdlrt
Compensating Depth Daylight on Median Slope	compdlmedlt	compdlmedrt
Cut/Fill Slope Break Point	slp1lt	spl1rt
Inside Edge of Ditch/Bottom of Fill Slope	slp2lt	spl2rt
Outside Edge of Ditch	oditlt	oditrt
Median Flow Line at Center of Median	mfl	
Tie Stake	tielt	tiert

Profile Grade Report Text Arranged in Alphabetical Order

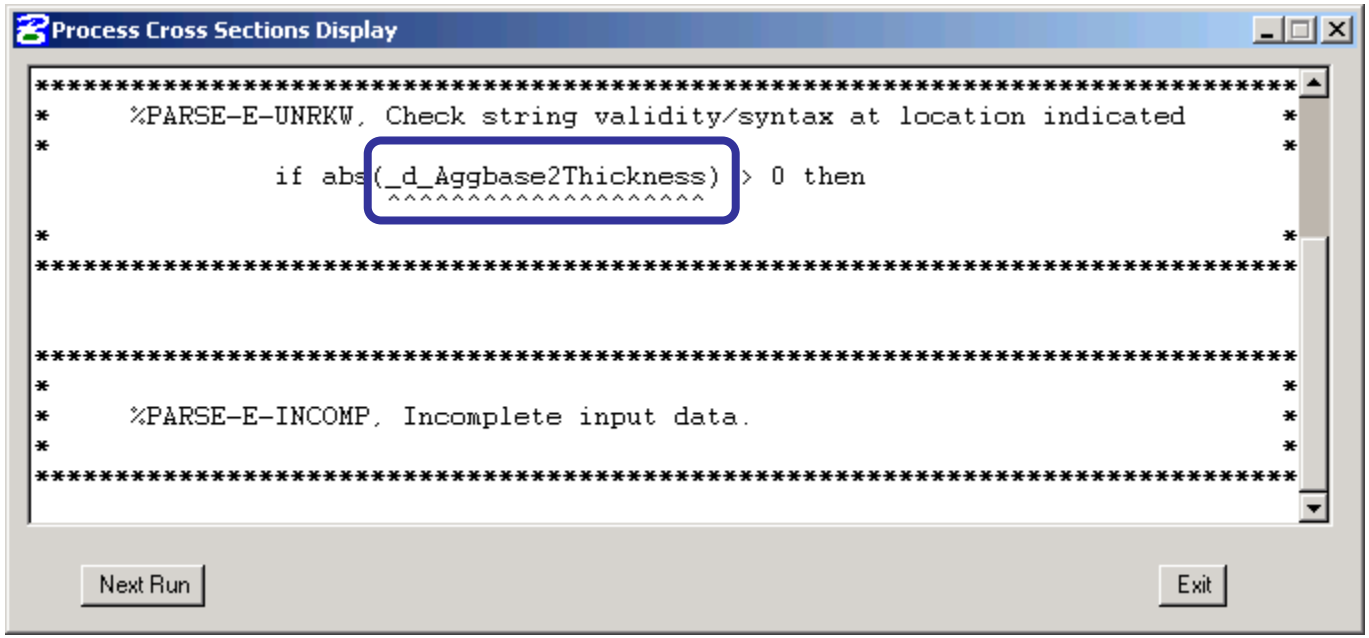
Text Plotted		
Left	**Right**	**Point Being Marked**
bdlmedlt	bdlmedrt	Bottom of Aggregate Base Daylight Point on Median Slope
bdlslplt	bdlslprt	Bottom of Aggregate Base Daylight Point on Outside Slope
boclt	bocrt	Back of Curb Next to Pavement
boc2lt	boc2rt	Back of Curb After U2 Shoulder
brmlt	brmrt	Berm
compdlmedlt	compdlmedrt	Compensating Depth Daylight on Median Slope
compdllt	compdlrt	Compensating Depth Daylight on Outside Slope
eoslt	eosrt	Edge of Shoulder
eplt	eprt	Edge of Pavement
fllt	flrt	Curb Flow Line
mfl		Median Flow Line at Center of Median
oditlt	oditrt	Outside Edge of Ditch
fbdlmedlt	rfbdlmedrt	Rock Fill Base Daylight Point on Median Slope
rfbdllt	rfbdlrt	Rock Fill Base Daylight Point on Outside Slope
slp1lt	spl1rt	Cut/Fill Slope Break Point
slp2lt	spl2rt	Inside Edge of Ditch/Bottom of Fill Slope
tielt	tiert	Tie Stake

Appendix 20 Troubleshooting Redefinable Variable Syntax Errors

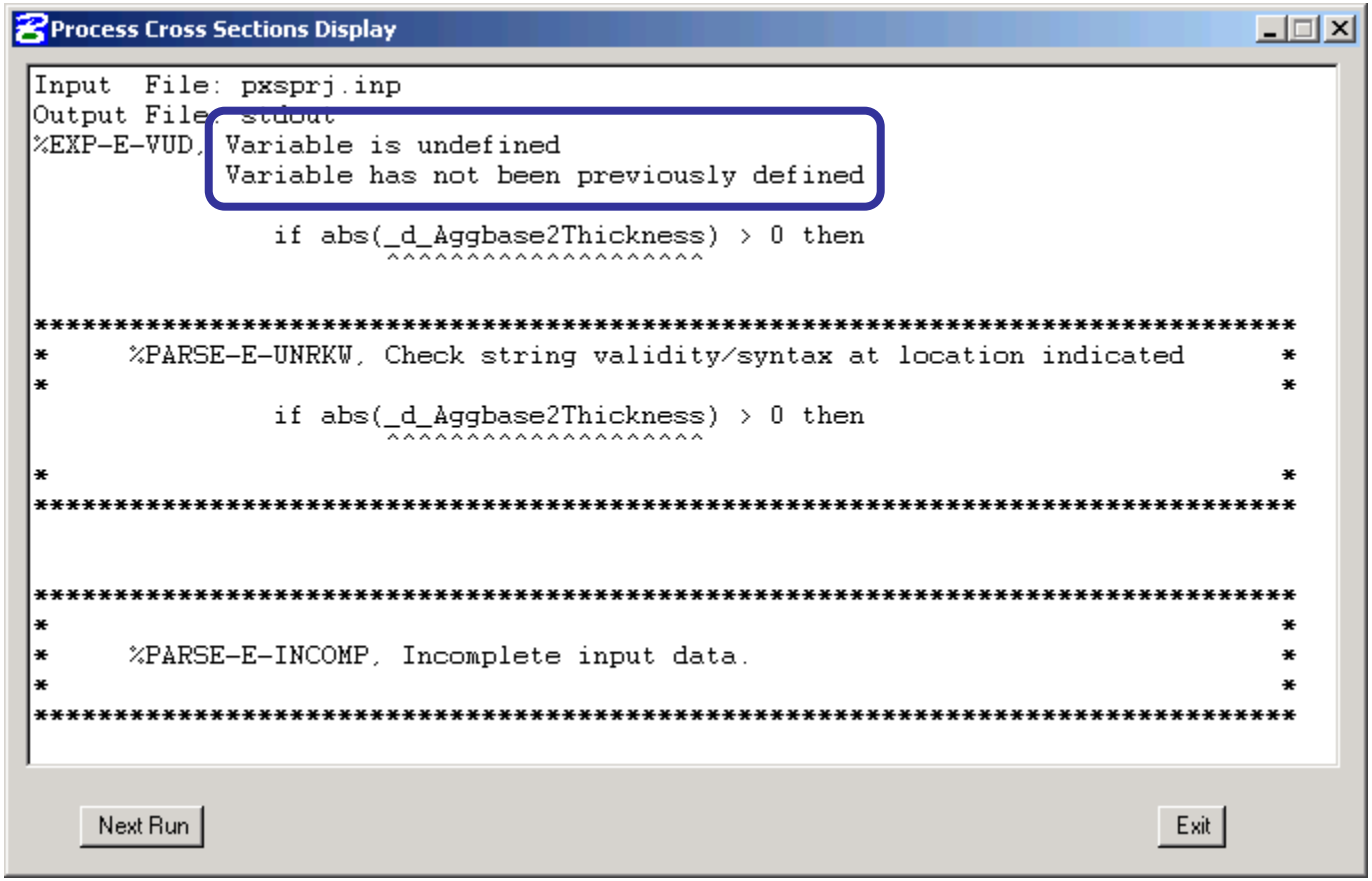
One of the problems that can occur while using the Typical Section Generator is to have a redefinable variable syntax error. If there is an error and you run the proposed cross sections, the process quickly ends and an error message is displayed in the Process Cross Sections Display ending in the phrase "**Incomplete input data**," as shown below. There are three common causes for this error. They are: 1) an undefined variable, 2) a missing or misspelled key word, and 3) a missing closing braces "}" at the end of an if-statement. The rest of this appendix gives information on how to determine which of these errors is the cause of the failed run and how to fix the problem. If there are multiple errors you need to repeat the error checking until all of them are removed.

Variable Is Not Defined

One of the errors is an undefined variable. This can be identified in two ways. The first is to notice the carets "^" under the variable name. The second way to identify this error is to look at the entire error message, which can be done by expanding the Display dialog. This has been done on the following page.

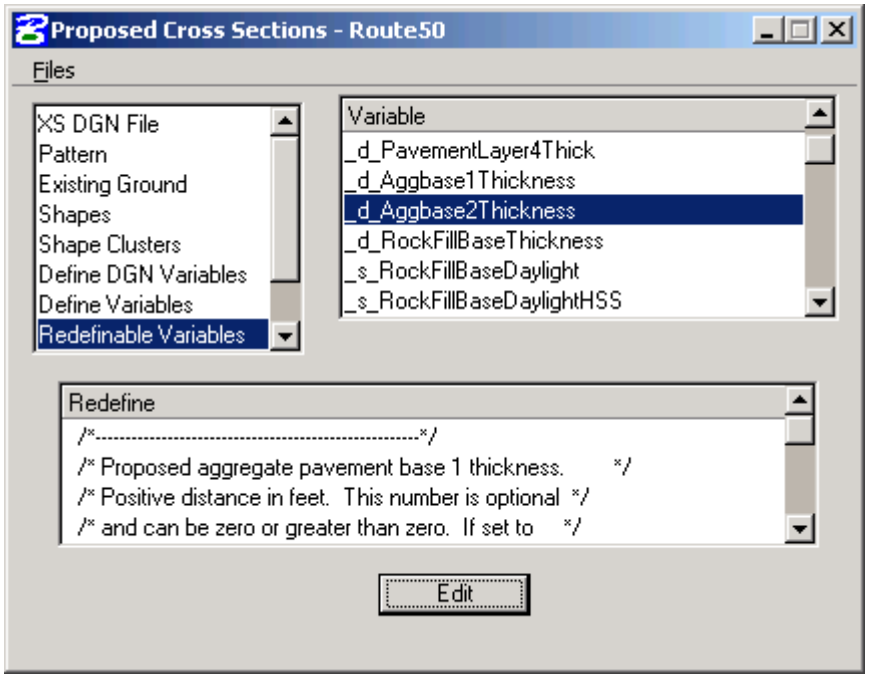


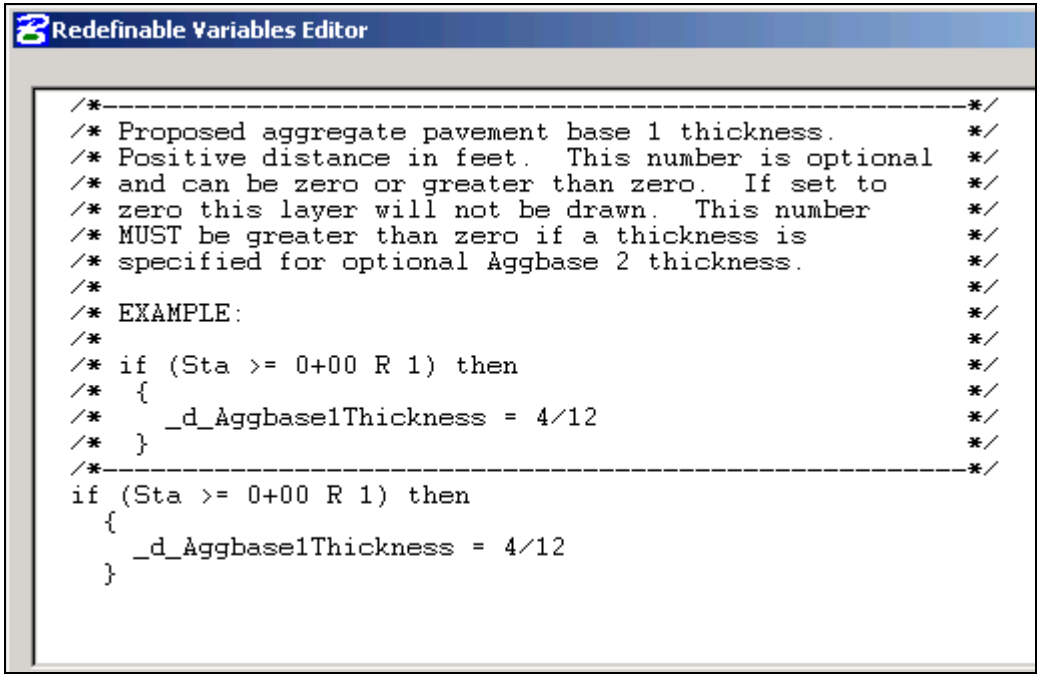
If you look at the full message, as shown below, you notice that it begins with the line “Variable is undefined.” It then goes on to let you know which variable it is. Typically this error occurs if the user opens the edit dialog for a redefinable variable, picks a different one from the list of variables before closing the edit box, and then clicks on the Save button in the editor while a variable is selected other than the one displayed in the edit dialog. The result is that one of the variables is defined twice and the other one is not defined at all.



To prevent this error from happening **always close the Redefinable Variables Editor before selecting another variable** from the list of variables in the Proposed Cross Sections dialog. To fix the error, note the variable that is not defined (_d_Aggbase2Thickness in this example) and click on either the **Next Run** or **Exit** button in the Process Cross Sections Display. Return to the **Redefinable Variables section** of the **Proposed Cross Sections** dialog; find the undefined variable in the **Variable** list, as shown in the figure on the left

below and click on the **Edit** button. When the **Redefinable Variables Editor** is opened, the problem becomes readily apparent as shown below in the figure on the right. For this example the entry for _d_Aggbase2Thickness was saved with the information for _d_Aggbase1Thickness instead of the correct variable.



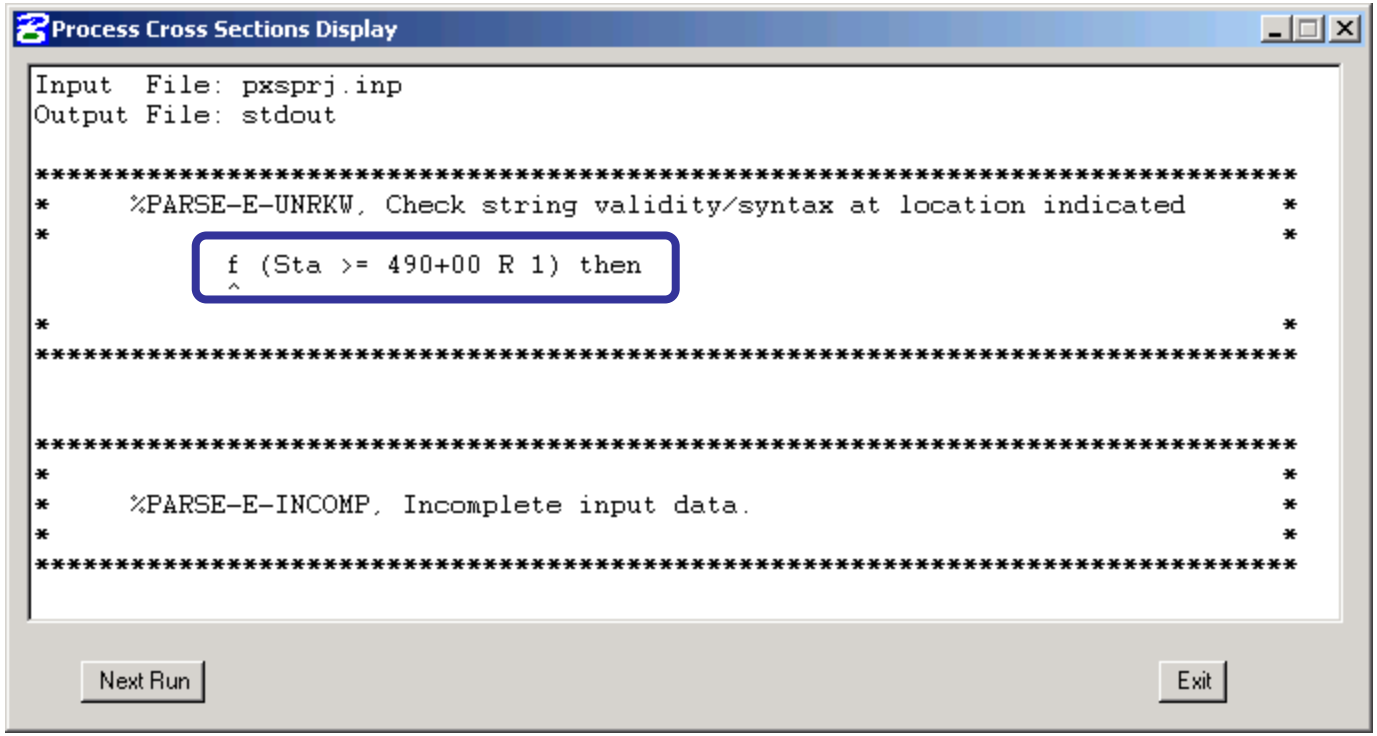


To complete the fix, edit the if-statement so that the correct variable is named and defined with the correct information. The needed changes for the example are shown below. **Note**: The information in the header above the actual if-statement does not need to be modified for the cross sections to run. It is there only for the user's benefit.

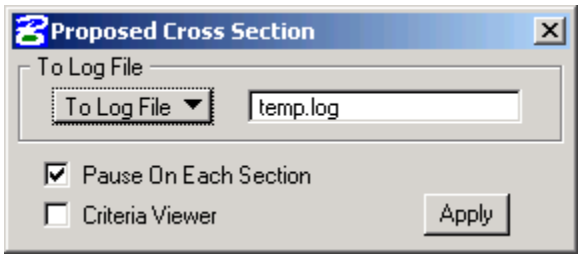
```
if (Sta >= 0+00 R 1) then
  {
    _d_Aggbase2Thickness = 0/12
  }
```

Missing or Misspelled Key Word

Another error is a missing or misspelled key word. From the expanded **Process Cross Sections Display** dialog shown below it can be noted that for this example shown, the "i" from the word "if" is missing. However, the dialog only shows the line with the syntax error and not the line indicating the variable being defined. To determine which variable it is, close the Process Cross Sections Dialog by clicking on either the **Next Run** or **Exit** button.

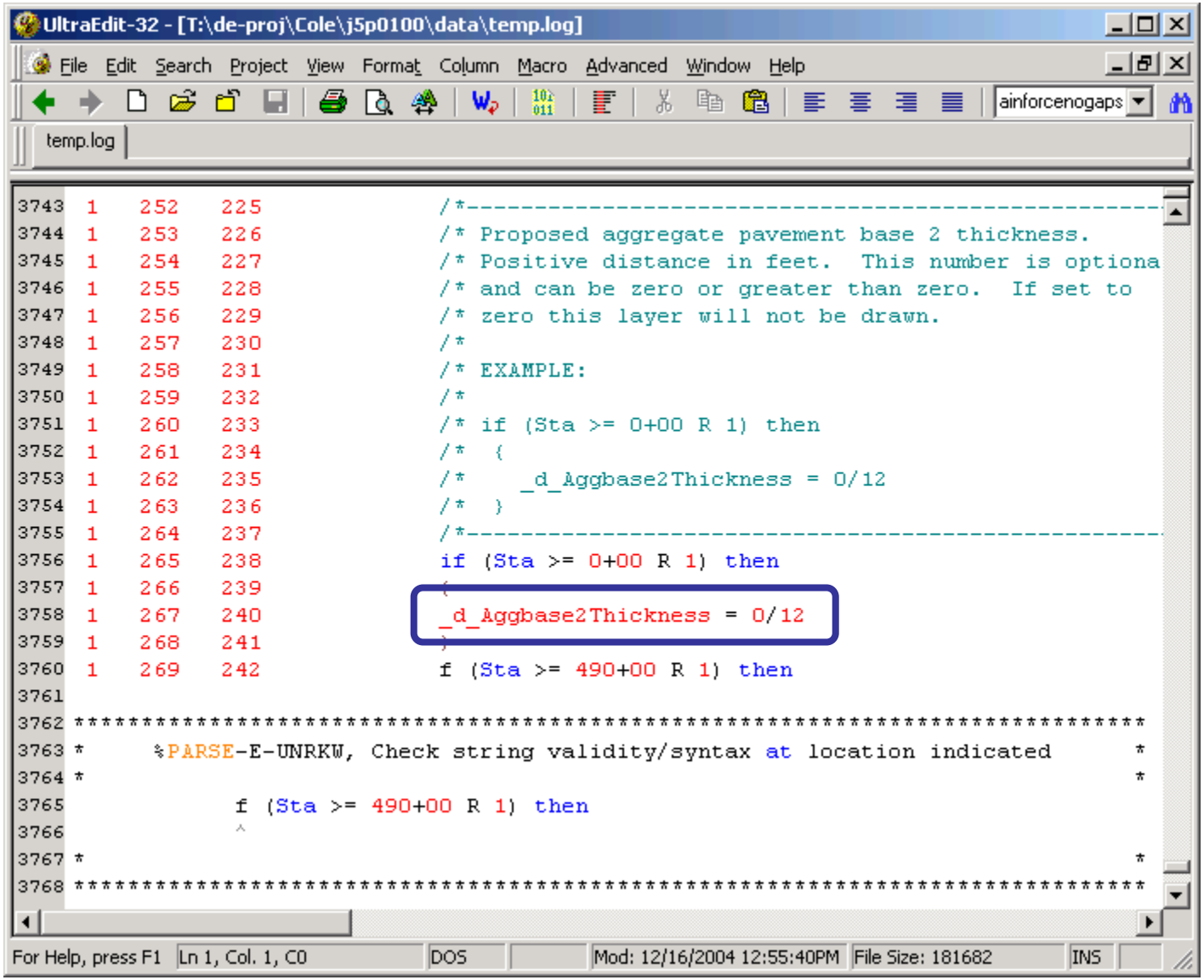


Determining which variable is being affected is a two-step process. The first is to run the proposed cross sections again, creating a log file. To do this switch the **To Log File** option from **"To Screen"** to **"To Log File,"** as shown in the dialog to the right. This dialog appears when you go to **Files > Run** in the **Proposed Cross Sections** dialog. You may either leave the name of the file to the default value of "temp.log" or rename it. In either case the log file is a text-formatted file written to the working directory.



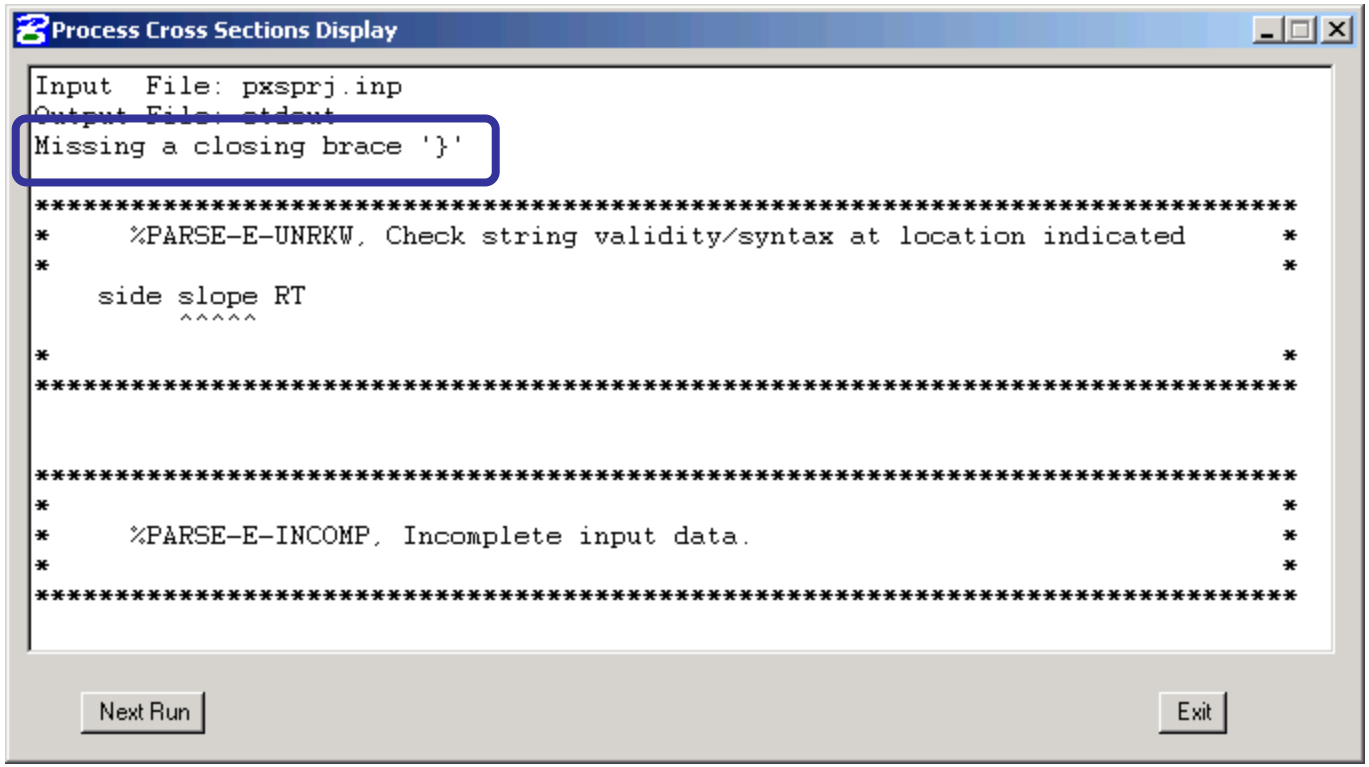
The second step is to open the log file in UltraEdit or another text editing program and scroll all the way to the end of the file. **Note**: The log file contains all of the information processed during the run and is more complete than the information written to the screen.

The relevant portion of the file is shown in the figure to the right. The numbered lines end with the line containing the syntax error. Two lines above that is the line with the variable definition, which indicates which variable needs to be modified. For example this it is _d_Aggbase2Thickness.



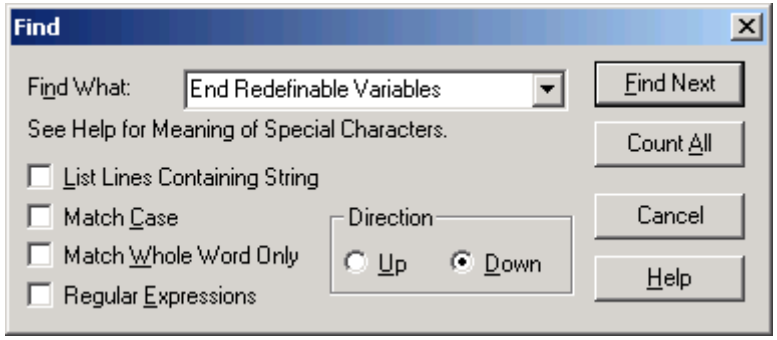
Missing Brace

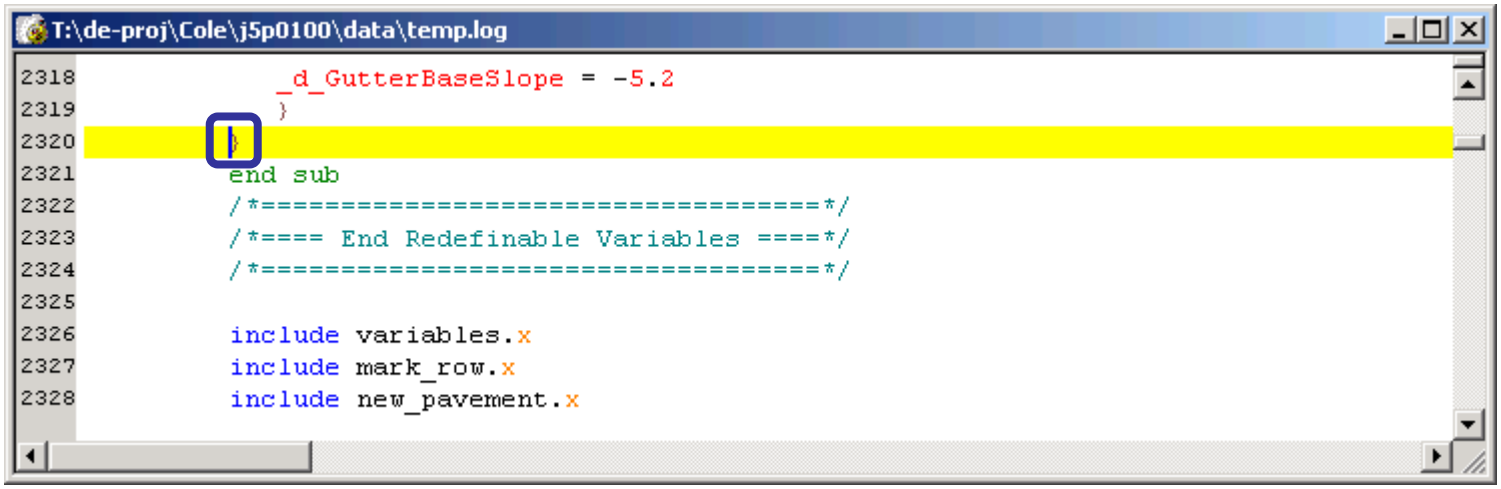
Another common error is to leave off the closing brace in one of the if-statement. Looking at the entire error message can also identify this error. This type of error begins with the line “Missing a closing brace ‘}’”, as shown below.



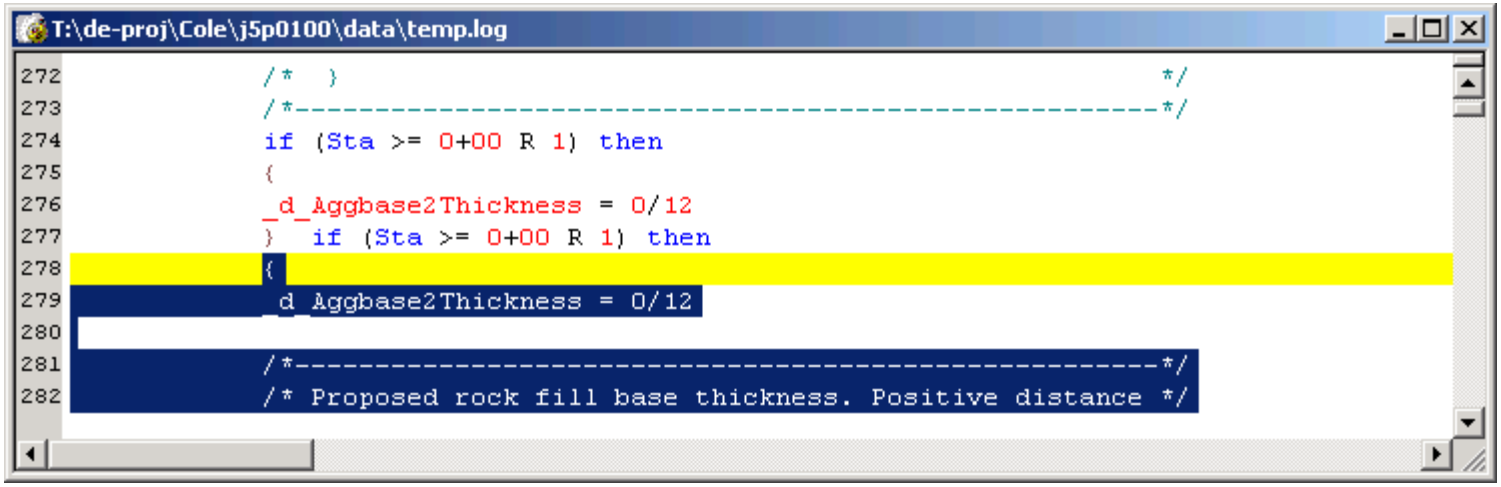
Finding the source of this error is a little bit more involved than the previous one. Like it, however, the first step is to create a log file as described above. The second step is to open the file in UltraEdit and use the programs ability to match braces, parentheses, and other types of opening and closing symbols. Information on using this ability is covered in **UltraEdit Help** under **Search Menu Commands \ Find Matching Brace**. The tool is activated by going to **Search > Match Brace** in the UltraEdit menu path or by doing a **Ctrl + B** keystroke.

To fine the missing brace, the user needs to go to the end of the section of the log file containing the redefinable variable definitions. The easiest way to do this is to go to the start of the file and use the UltraEdit Find tool (Menu path: **Search > Find**). This brings up the following dialog. Type "**End Redefinable Variables**" in the **Find What** field and click on **Find Next**. This takes the user to the part of the file shown in the bottom figure on the page.





Place the cursor in front of the last closing brace before the End Redefinable Variables text, as shown above, and activate the **Match Brace** tool in UltraEdit by either going to **Search > Match Brace** or doing a **Ctrl + B** combination. This highlights everything between the matching braces and take you to the start of the selected text as shown in the figure on the following page.



An examination of the text at the start of the selected portion in the figure above indicates that the closing brace for the second if-statement for the redefinable variable _d_Aggbase2Thickness is missing. To fix the error, simply return to the Proposed Cross Sections dialog and edit the redefinable variable to add the missing brace.